Molectron Corporation

Molectron
MY Series

Multiwavelength Pulsed Nd:YAG Lasers

SERVICE MANUAL

Molectron Corporation

177 N. WOLFE ROAD, SUNNYVALE, CALIFORNIA 94086 (408) 738-2661 TELEX: 357436

Text Revised May 1982

Molectron MY Series Nd:YAG Lasers

WARRANTY

Molectron guarantees its products to be free of defective workmanship and materials for a period of one year from date of delivery, with the exception of flashlamps. Our liability under this warranty is limited to servicing the equipment at the factory or on location, as deemed appropriate by Molectron personnel, and to repair or replacement of defective parts. Molectron shall not be held responsible for consequential operating conditions*, accidents, misuse*, or negligence*, will void the warranty. No product or part thereof may be returned without Molectron's prior approval. All defective parts become the property of Molectron and shall be returned to Molectron Corporation.

The above warranty is the only warranty offered by Molectron Corporation for this product, and supplements the warranty provisions contained in our standard conditions of sale.

* In particular, Molectron will not be responsible for damage to optics caused by the following user malpractices:

A. Operation at high power of a misaligned or damaged laser (see Warranty Addendum).
B. Failure to maintain the optical path free of contamination (see Warranty Addendum).
C. Allowing retroreflections from experimental optics to re-enter the laser chassis (see MY Service Bulletin "Back-Reflections & 'Ghost' Foci").
D. Alignment or realignment of the laser using procedures & practices other than those contained in the Service Manual.

Any of these user malpractices will very probably result in catastrophic failure of one or more (possibly all!) optical components.

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WARRANTY ADDENDUM

This addendum defines "contamination", & details some recommended practices.

Contamination includes dusts, graphite (from pencils), soot, lint, dew (city water below dew point), tobacco smoke, oils (including fingerprints), condensible vapors (e.g. resin "smoke" from soldering; outgassing from oils, greases, paints, cements, & plastics), & "blow-off" products (generated when the beam strikes partial absorbers such as optic mounts, O rings, rubber pads, "footprint" paper or other developed photographic print paper, or painted surfaces). Note well that "blow-off"dust can be generated at the aperture in an under-coupled or misaligned oscillator, from whence it can move to contaminate the optics on both sides of the aperture.

Molectron strongly recommends that the laser chassis be kept closed up. When the top covers must be removed (except briefly), the laser chassis should be inside a polethylene tent or an acrylic or polycarbonate box. Before opening the beam line, wipe down the laser & table, using a lint-free wiper moistened with alcohol. Do not set open containers of liquid (e.g. coffee cups or dye cuvettes) on or in the laser chassis.

Molectron also recommends that the symmetry of the low-energy beam profile be monitored whenever the system is turned on after being off for several hours; this is especially important if the lab undergoes drastic temperature changes.

MOLECTRON CORPORATION

Standard Conditions of Sale

PRICES AND TERMS. Inside the U.S.A. and Canada: All prices are quoted F.O.B. Sunnyvale unless otherwise provided. Standard Terms are net 30 days from the date of invoice provided credit with Molectron has been approved. Pro-rata payments shall become due as partial shipments are made. Interest on accounts past due will be billed at a rate of 1-1/2% per month.

Outside the U.S.A.: Terms for direct orders from outside the U.S.A. and Canada to Molectron are irrevocable letter of credit unless other terms are arranged before the order has been placed. However, Molectron International Prices include electrical input power modification and warranty service. International Prices for direct sales outside the U.S.A. quoted in U.S. dollars are F.O.B. Sunnyvale and do not include forwarding and import costs or taxes. Molectron will prepare pro-forma invoices and/or CIF or C&F quotations in U.S. dollars upon request.

International customers may also purchase Molectron products from authorized representatives. Prices and terms for such orders are mutually determined between the customer and the representative. Prices quoted by such representative usually have a local F.O.B. point.

DELIVERY. Unless otherwise specifically agreed to by Molectron, delivery of products shall be made F.O.B. Molectron, and title shall pass at that time. Shipping dates are approximate and are based upon prompt receipt of all necessary documents and information. Molectron will use its best efforts to deliver as specified herein but shall not be liable for delays in delivery occasioned by any cause beyond its control or beyond the control of its suppliers.

Shipments made F.O.B. Molectron shall be at the risk of the Purchaser who shall make all claims to the carrier in the event of damage to shipped material or losses in transit. Purchaser shall notify Molectron in writing relative to any shortages, within 10 days from receipt of shipment.

TAXES. Molectron's prices do not include sales, use, excise, or similar taxes. Consequently, in addition to the price specified, the amount of any present or future sales, use, excise or similar tax applied directly to the sale hereunder shall be paid by Purchaser or in lieu thereof the Purchaser shall provide a tax exemption certificate acceptable to the taxing authorities.

CANCELLATION. Orders or parts of orders cancelled prior to shipment will be subject to a cancellation charge of $250.00 or 2% of the selling price, whichever is the greater. Orders or parts of orders cancelled following shipment will be subject to a restocking charge of $500.00 or 10% of the selling price, whichever is the greater. In addition the buyer shall pay for all shipping expenses for delivery and return, including customs and agent fees, if any. These restocking and incidental charges do not apply in cases where the equipment in question fails to perform to published specifications.

LIMITED WARRANTY AGREEMENT. Molectron warrants all products of its manufacture to be free from defects in material and workmanship. This warranty is effective for one year from the date of shipment. In addition to this warranty statement, other warranty provisions for specific products are described in the appropriate operating manual.

Upon prompt notification by the Purchaser, Molectron will correct any defects in equipment of its manufacture either by repair in our factory or on site or by supply of replacement parts to the Purchaser at Molectron's option.

Molectron must decide to its own satisfaction that the equipment is defective and has not developed malfunctions as a result of misuse, modification or abnormal conditions of operation.

Any special test or requirement placed upon Molectron products or products of other manufacture used in Molectron systems must be mutually agreed upon in writing by Molectron and the Purchaser at or prior to placement of the purchase order.

Molectron reserves the right to make changes in design or construction of its products at any time without incurring any obligation to make any changes whatsoever on units previously purchased.

This warranty is expressly made by and accepted by purchaser in lieu of all other warranties, except those contained in the operating manual for each product, including warranties of merchantability and fitness for particular purpose, whether written, oral, expressed, implied or statutory. Molectron neither assumes nor authorizes any other person to assume for it any other liabilities with respect to its products. Molectron shall not be liable for normal wear and tear, nor for any contingent, incidental or consequential damage or expense due to partial or complete inoperability of its products for any reason whatsoever. In no event shall Molectron's liability exceed the original purchase price of the equipment.

REV	DATE	ECO

MANUAL REVISION LEVEL

As a result of text changes and/or of Engineering Change Orders (ECO's) to released documents (drawings, procedures) incorporated in this Service Manual for MY Series Nd:YAG Lasers, this copy is at revision level:

AC

REV	DATE	ECO

REV	DATE	ECO

REV	DATE	ECO

SIZE	DRAWING
A	940036

PREP. BY Fountain

DATE 4/29/82

SHEET 1 OF 1

REV —

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SECTION I

GENERAL INFORMATION

1-1 INTRODUCTION

The information contained in this Service Manual is not required for installation, operation, or maintenance, but only for any servicing that may become necessary. This manual complements the Installation, Operation & Maintenance Manual (IOMM), which contains no servicing information. Consult the IOMM for: a general description of the laser system; a survey of the controls, inputs, & outputs; operating information, including safety precautions; & routine maintenance (excluding flashlamp replacement, which is covered in this Service Manual).

This Service Manual assumes that the user is reasonably familiar with the IOMM. Given that, Section II covers simple trouble-shooting. Section III covers optical alignment (including replacement of optics), while Section IV covers the system's electronics (including interlocking & timings).

1-2 REPLACEMENT SCHEDULE

The only components that have a reasonably definable life are the flashlamps; all of the other components (with the exception of the output window(s) and any other optics that may be exposed to contaminants) should last for years of normal operation. The lifetime of the flashlamps will depend on the levels at which they are operated, but are nominally 3×10^7 shots (about 4 months of single-shift operation @ 10 Hz); an events counter inside the rear door of the Power Console displays the number of oscillator lamp shots in units of 100 shots (thus, a counter reading of 300,000 corresponds to 3×10^7 shots). Oscillator lamp end-of-life is evidenced by an increase in input energy required to attain threshold over the value found during step (15) of IOMM sub-section 3-2. Amplifier lamp end-of-life is evidenced by a decrease in output from that previously yielded by known values of amplifier lamp input energy and oscillator output energy. Molectron suggests replacing all oscillator and amplifier lamps at the same time. The oscillator flashlamps in the MY32 & MY34 are each Molectron p/n 0060-2391; all other flashlamps are each p/n 0060-2392.

To change lamps, CAREFULLY remove the flashlamp connectors: hold a connector by thumb and one finger near its open end and guide it STRAIGHT off the flashlamp electrode stud (while removing the second connector from a given lamp, restrain the other lamp end sufficiently to prevent large axial movement); excess side pressure or torque will cause lamp breakage. Attempt to rotate the top lamp around its own axis, to free any adhesion between the O rings and the lamp; this may require loosening the screws in the lamp O ring clamps by one half turn or so, but these screws should be loosened no more than necessary. Note the position of the red electrode stud, and then slide this lamp out of the head, until air starts to leak in to the laser head and the water in the head starts to drain back into the coolant plumbing; watch the O rings to ensure that they are not pulled out of their grooves. Allow the head to drain, then remove the top lamp; repeat this process for the bottom lamp, being prepared in this case for possible leakage of coolant that may be left in the bottom of the head. Without touching the silica part of a new lamp with the bare skin, clean it with a wiper (preferably lint free) dampened with ethanol; try not to remove the red color from the anode electrode stud (if, inadvertently, you do, the cathode is the electrode near the envelope tip-off: recolor the opposite electrode stud, red). Put this lamp in the bottom position (it is advisable to wear lint-free gloves while performing this operation), in the same orientation as the old lamp, and with the tip-off pointed more or less toward the laser rod; watch the O rings to ensure that they are not pushed out of their grooves. If you have difficulty getting the tipped-off portion of the lamp into the laser head, loosen the screws in the lamp O ring clamps as necessary. Repeat this process for the new lamp for the top position. Tighten any loosened O-ring clamp screws. Reinstall the flashlamp connectors (c.f. IOMM subsection 2-3). Be aware that new lamps may not simmer well until they have accumulated enough shots to roughen the electrodes; hence, especially at high repetition rates, occasional misfires may occur during the first hour or so of operation after lamp replacement

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SECTION II

SIMPLE TROUBLE-SHOOTING

The information below is intended to aid you in solving simple problems and in finding the proper section of the Service Manual for some of the more major possible problems.

1.	Nothing happens when KEY SWITCH turned ON.	1. Prime AC power phase "A" (ΦA) missing. 2. Fuses F1 and/or F2 open (power distribution chassis).
2.	KEY SWITCH activates only fans and power distribution chassis POWER lamp.	1. Power distribution chassis SERVICE/NORMAL switch in SERVICE position. 2. Defective 28 VDC power module in power distribution chassis. 3. See subsection 4-9.
3.	READY lamp won't illuminate.	1. Check the following interlocks: laser chassis covers (2); harmonics box lid and/or 4-contact connector in output end of harmonics box; PFN chassis cover. 2. Defective lamp. 3. See subsection 4-9.

4.	WATER lamp won't illuminate.	1. Insufficient water flow (check the valves and filters -- including the drain's valve, if any -- of the city water supply; check for hose kinks). 2. Jammed or defective city water flow switch. 3. Defective lamp.
5.	Pump motor won't start.	1. WATER circuit breaker OFF. 2. READY lamp not illuminated. 3. Motor overheated and/or jammed. 4. Prime AC power ΦB missing. 5. See subsection 4-9.
6a.	Pump motor starts, but won't stay on.	1. START button released before ON lamps illuminated.
6b.	ON lamps won't illuminate.	2. WATER lamp not illuminated. 3. Jammed or defective laser coolant flow switch. 4. Insufficient laser coolant flow (has pump lost its prime? Is laser coolant particle filter plugged? Is a hose kinked? etc.). 5. See subsection 4-9.
7.	ON lamps illuminated but oscillator flashlamps not firing.	1. Charging power supply circuit breaker off. 2. Fuse F5 is open. 3. Prime AC power ΦC missing.

7.	(Continued)	4. Flashlamps not simmering. 5. PULSE RATE switch in EXT position and incorrect signal to LAMP TRIGGER input. 6. Main Control Card not fully plugged in. 7. See Symptoms 16 and 18. 8. See subsection 4-3.
8.	ON lamps illuminated but amplifier flashlamps not firing.	1. See Diagnosis/Action steps 1-7 for symptom 7. 2. Fuses F3 and/or F4 open. 3. See subsection 4-3.
9.	Flashlamps not simmering.	1. Lamp(s) connected with anode and cathode reversed. 2. Trigger transformer not connected to laser head. 3. See subsection 4-4B.
10.	Shutter won't open, even after built-in delay time.	1. Check room access door interlock(s) and/or J1 of power distribution chassis. 2. Lamp pulse rate not between 5(10) and 20(30) Hz, inclusive. 3. See subsection 4-8.

11. No IR laser output, but shutter is open and flashlamps firing.	1. Remote control pendant Q SWITCH rocker switch is in SINGLE SHOT position, and service subpanel Q SWITCH rotary switch is in INT or EXT position. 2. Q SWITCH rotary switch in EXT position, and no external input. 3. OSCILLATOR input energy below laser threshold. 4. See subsection 3-2.
12. IR laser output is O.K., but harmonic power is low.	1. Service subpanel Q SWITCH rotary switch in LONG position. 2. Harmonic crystal(s) not tuned to primary peak of output-vs.-angle curve. 3. Crystal(s) and/or IR half-wave plate (at harmonics box input) rotated about beam axis from proper orientation. 4. Harmonic beamsplitters are mixed up (they should be used in reflective pairs, with the shortest wavelength of a multiwavelength beam being reflected out first; thus, for example, a beam containing 1064 nm, 532 nm, and 355 nm should encounter, in this order: a reflector for 355 nm, paired with its duplicate, then possibly a reflector for 532 nm, paired with its duplicate, then the 1064-nm output optics; c.f. Figs. 1 & 9 of the IOMM).

12. (Continued)		5. Apparently weak THG following strong Type II SHG, only: THG xtal may be tilted in wrong direction (from normal incidence) and thus acting as a second Type II SHG xtal; when it is "peaked up", the SHG leakage through the UV output port increases, and can be misinterpreted as low UV power. 6. Pulse durantion stretched per 970295. 7. See step (49) of 970270.
13.	SINGLE SHOT position of remote control pendant Q SWITCH rocker switch does not sufficiently disable repetitive laser emission.	1. Service subpanel Q SWITCH rotary switch in LONG position. 2. Step (10d) of subsection 3.3 of IOMM has been implemented. 3. Pockels cell is misaligned. 4. Input energy too high. 5. Pockels cell high voltage too low. 6. See subsection 4-5C and/or steps (20) and/or (24)-(36) of 970270.
14.	Repetitive laser emission not disabled when service subpanel Q SWITCH rotary switch in EXT position and no external input applied to Q SWITCH TRIGGER connector.	1. See Diagnosis/Action steps 2-6 for symptom 13.
15a. Output low. 15b. Output erratic. 15c. Beam quality degraded		1. Oscillator input energy too near threshold; if low energy is required, implement step (10c) of IOMM subsection 3.3, or attenuate output optically.

15. (Continued)	2. Optical misalignment and/or damage. See subsections 3-1, 3-2. 3. See Diagnosis/Action steps 3-6 for symptom 13. 4. See step (48) of 970270.
16a. Laser operating O.K., but then system shuts down. 16b. Laser operating O.K., but then shutter closes and lamps stop flashing (pump motor and ON lamp remain on).	1. A city water pressure fluctuation, of greater or lesser duration, has temporarily tripped the flow interlock; increase the flow slightly and press the START button. Probably the pressure to the system is marginal: check for hose kinks, clogged filters, etc.
17. Laser runs weakly, if at all, and hoses are warm.	1. City water flow switch jammed or defective, and city water flow is insufficient. 2. System has been plumbed into a hot water line.
18. (Not applicable to oscillators of MY32-10, MY34-10.) Lamps flash a few times and then stop, but simmer is O.K.	1. Replace fuse F1 of associated charging power supply, (see dwg. #060162).

SECTION III

OPTICAL SERVICING

Molectron recommends that optical surfaces not be cleaned on a routine basis. If cleaning is necessary (c.f. IOMM #4-1(2), p. 4-1), however, see IOMM #4-1(4,5), pp. 4-2 through 4-4, for the proper equipment, precautions, and procedure, WITH WHICH THIS WHOLE SECTION III ASSUMES YOU ARE FAMILIAR! Replacement of optics should never be required if due care is taken, never to operate a misaligned laser at high power, and to protect the optics from contamination. Realignment should not be required unless the laser chassis is subjected to severe vibration or shock, or unless your installation is afflicted with a "knob-twiddler". Replacement is covered in subsection 3-1, while realignment is dealt with in subsection 3-2.

3-1 OPTICAL COMPONENT REPLACEMENT

This subsection concerns itself with the mechanical aspects of component replacement: subsequent realignment is covered in subsection 3-2. This laser system was assembled and prealigned in a Class 100 clean facility, and final-aligned and tested in a semi-clean room set up according to the precepts of IOMM #4-1(4), p. 4-3; Molectron strongly recommends that optical servicing be performed under conditions that approximate this ideal as closely as practicable. When the laser chassis is open it should be protected as much as practicable (e.g. with a clean plastic sheet).

No optical surface should ever be touched with the bare skin, whether or not it is hygroscopic. Handling equipment & precautions are covered in the cleaning procedure cited above.

The optics may be ranked according to vulnerability as follows:

1) output optics
2) other harmonics-box optics (intermittent airborne contamination);
3) "front" oscillator mirror (higher power density); the "front" end is the output end, opposite the umbical end;
4) laser rod(s) ("dewing" or coolant leaks);
5) remaining optics.

A penlite and dental mirrors (used only when the system is off, of course!) will greatly facilitate in situ inspection; Molectron recommends the "Conduct-a-Lite", available from

National Camera, 2000 W. Union Ave., Englewood, CO 80110; phone: (303) 78901893. Since it increases the risks of misalignment and of exposure of optics to contamination, however, such inspection on a routine basis is neither recommended nor desirable for optics "upstream" of the harmonics box: these optics should be inspected only if the laser's performance gives reason to suspect their integrity.

The details of inspection access for a given component, if not obvious, are explained in the replacement procedure for that component. In general, however, contamination and damage (unless severe) are most easily identified by enhanced small-angle forward or backward scattering of incident light.

A. Harmonics Box and MY32 Output Telescope

The following optics are included in these subassemblies (quantities depend on options you have ordered):

Coma-Free Positive Lens: 0060-1452

Coma-Free Negative Lens: 0060-1445

Non-UV Window, Coated:	0060-2230
UV Output Window, Coated:	0060-2220
Green Window, Coated:	0060-2210
IR Window, Coated:	0060-2200
266-nm λ/2 Plate:	0060-1115
355-nm λ/2 Plate:	0060-1114
532-nm λ/2 Plate:	0060-1113
1064-nm λ/2 Plate:	0060-1112
1064-nm λ/4 Plate:	0060-1111
Harmonic Beamsplitter, Coated (FHG):	0060-2260
Harmonic Beamsplitter, Coated (THG):	0060-2250
Harmonic Beamsplitter, Coated (SHG):	0060-2240
Fundamental Reflector, Coated:	0060-6220
*Window, Non-UV Coated, Oven:	0060-2080
*Window, UV Coated, Oven:	0060-2070
*Window, Green Coated, Oven:	0060-2060
*Window, IR Coated, Oven:	0060-2050
*Harmonic Xtal (FHG):	0060-2040
*Harmonic Xtal (THG/SHG) (Type II):	0060-2030
*Harmonic Xtal (SHG) (Type I):	0060-2020
**Polarizer, 532-nm:	0060-5940

*NEXT ASS'Y:	Oven ass'y, Type I SHG:	0060-0321
	Oven ass'y, Type II SHG:	0060-0322
	Oven ass'y, THG:	0060-0323
	Oven ass'y, FHG:	0060-0324
	**(Part of MY32-VBS):	0060-4461

Inspection access to any of these parts is obvious. To remove any of these optics not part of a harmonics xtal oven ass'y or telescope, first remove the whole mount from the harmonics box by loosening the three Syn-Clamps. To remove any oven optics, first remove the oven from its mount by removing the four socket-head cap screws at the $\pm 45^{o}$ directions (the heads are facing the output end). To remove a telescope lens, first remove the whole mount by removing the two socket-head capscrews (note the telescope's orientation).

Given the preceding paragraph, mechanical access to most of these optics is obvious. To remove a telescope lens, use a spanner wrench with "pencil point" tips to unscrew the retaining ring (one source for an appropriate spanner is: National Camera, 2000 W. Union Ave., Englewood, CO 80110; phone (303) 789-1893). To remove a harmonic crystal from its oven, first read the next paragraph; then remove the end bell that does not have wires attached, note the orientation of the dots on the crystal's nonoptical faces, & shake the crystal out into you hand (gloved -- see next paragraph). If the crystal cannot be shaken out, remove the window from the remaining end bell & gently push the crystal out with a swab.

The KD*P & KDP harmonic crystals are hygroscopic, & hence should not be exposed for more than about 30 sec. to an atmosphere of relative humidity (RH) above about 30%: disassembly & reassembly may have to be conducted in a glove box, or replace the oven ass'y. (In a pinch, use a clear bag or box that is continuously being flushed with oil-free dry nitrogen or with any suitable oil-free gas--including air -- that has been passed through a desiccant & a dust filter). The local RH will usually be above the safe level, near bare skin: powder-free plastic or rubber gloves MUST be worn and, preferably, lint-free clean cloth gloves should be worn over those.

The optics tabulated above as "windows" have no preferred orientation. The "$\lambda/2$ plates" have a preferred rotational orientation about their axes, but this is determined during realignment & need not be considered during physical replacement, per se. The "lenses" must be mounted with the most-curved surface on the side with the most-parallel light (i.e. the least-curved surface of each lens will face the inside of the telescope). The "beamsplitters" must be mounted so that the incident beam strikes the dichroic coating (& the transmitted beam passes through the anti-reflection coating; in the mount, this AR side is against the retaining strips). The "reflector" or "polarizer"

must be mounted so that the incident beam strikes the coated surface (the uncoated surface is against the retaining strips of the mount). The replacement "xtals" must have their indicating dots oriented identically with those on the crystals being replaced. For any optics that have a preferred orientation, it is always a good idea to compare the replacement with the original, before the latter is removed from its mount, to ensure that you do in fact have the proper replacement part & that you can recognize the proper orientation.

B. Hazard Warning Note

The procedures of C. through G., below, involve displacement or removal of portions of the noninterlocked protective housing (as defined by the Bureau of Radiological Health of the Food & Drug Administration of the Public Health Service of the U.S. Dept. of Health, Education & Welfare):

DANGER - Visible and/or invisible laser radiation when open. AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION.

CAUTION - Hazardous electromagnetic radiation (visible & invisible flashlamp emission) when open.

These portions of the protective housing must be replaced per the instructions of subsection 3-2. The laser system must not be turned on during or after displacement or removal of portions of the protective housing, except under the conditions, & by following the procedures, specified in subsection 3-2. See Fig. 5 for BRH Warning Label locations.

C. Input Telescope

The following optics are included in this subassembly, if present (MY32 & MY33 only):

Coma-Free Negative Lens: 0060-1443

Coma-Free Positive Lens: 0060-1451

Inspection access is obtained by removing the corrugated rubber tubing from each end of the telescope. This telescope may be treated in the manner described for the output telescope in A, above, except that access to the retaining ring is obtained by unscrewing the snout.

D. Amplifier Head

The only optic (aside from the flashlamps: see subsection 1-2) in this subassembly, if present (MY34 & MY35 only) is:

*YAG Rod (8.5 mm): 0060-2463

*NEXT ASS'Y: Amplifier laser head: 0060-0041

Inspection access is obtained by removing the stainless steel beam tubes. These tubes are friction-fit to the head, & should be pulled straight out (BE CAREFUL to neither twist a beam tube about its axis nor cock it up or down: the latter may break a lamp, the connectors of which are on, & the former generates an excessive number of wear particles that may contaminate the rod).

Laser rod replacement MUST be done in a clean facility that is AT LEAST as good as class 10,000 (per Federal Standard 209B: < 10,000 particles of size > 0.5 μm, per cubic foot of air), which is still marginal but also roughly 100 times as clean as the "typical" indoor area. Further, the atmosphere in this facility MUST NOT contain any volatile condensible materials (e.g. oil vapors). If you do not have access to such a facility, then you must replace the whole laser head subassembly except the flashlamps. (A laser head subassembly --except lamps-- can be assembled & bagged in Molectron's class 100 clean facility & then shipped without significantly compromising its cleanliness.) In this case, skip the steps below that refer to removing & replacing the rod.

To remove the laser head, first remove the beam tubes, if on. Remove the wire that comes from the trigger transformer. Remove the flashlamp connectors & flashlamps per subsection 1-2. Remove the plumbing connectors (clip them together to prevent accidental flooding), starting with the uppermost one & being prepared for coolant spillage. Remove the two screws that hold the upper (white) insulating plate to the lower (green or black) one. DO NOT remove (or loosen) the two visible screws that hold the lower (green or black) insulating plate to the optical baseplate: This will only complicate realignment, & there is a third (pivot) screw that will still prevent complete removal. Tilt the laser head so that the plumbing fittings are up (to prevent spillage) and, without tilting the head toward either end (again, to prevent spillage), remove the laser head from the chassis. Dump any remaining coolant from the laser head.

To remove the (3" long) rod from the laser head once the latter is out of the laser chassis, you will need Molectron's amplifier rod nut spanner, 0980-1780. With the spanner, loosen each rod nut until it just no longer compresses the O ring. Put the laser head on its side without plumbing fittings, & remove the side that has fittings (by removing the 8 socket-head cap screws around the perimeter; DO NOT loosen the two screws toward the center). Carefully dry the removed elliptical half-reflector & end plates in a manner (e.g. by blotting) that will not scratch the gold coating. Put a clean sheet of Kodak lens cleaning paper over the cotton tip of a clean swab, & use this to push the laser rod through the head until it can be grasped & removed at the other end by hand (gloved, of course). Dry the barrel of the rod & clean the end faces (if there is no bulk damage, the rod can be repolished & recoated; an undamaged & unstained face need not be reworked). Roll the rod up in lens tissue & then do with it whatever is appropriate. Remove the clear glass flow tube from the laser head & dry it (a slight brownish or greyish coloration due to "solarization" -- color center formation by UV radiation from the flashlamps -- is normal). Carefully dry the remaining half-reflector & end plates, & restore the flow tube to its position.

Before installing the replacement rod (in a clean area!) CHECK to ensure that any parts of the laser head that might be touched by the rod during installation are dry. Being very careful not to mar the end of the rod, insert the clean new rod into one end of the head & push it through as far as practical. Put a (new) clean sheet of lens tissue over the tip of a (new) clean swab & use this to push the rod most of the way through the head. Without allowing the flow tube to fall out of the head, orient the head so that the rod is hanging from the O ring through which it has been inserted (i.e. this O ring is now at the top). By slightly varying the tilt of the head, & the angle of the force exerted on the rod by the protected swab, approximately center the rod so that an equal amount protrudes into each rod nut. Inspect the rod ends to make sure that both are clean, dry, & unmarred.

Set the head on its upper (white) insulating plate (the flow tube can hang from the rod) & direct a He-Ne laser beam or an autocollimator beam through the rod, after first having set up the beam parallel to the surface on which the head is resting; the rod centerline is 2.25" (57,15 mm) above this surface. Rotate & translate the head in a horizontal plane until you can see the back-

reflections from both faces. Carefully use a serrated-jaw tweezer with slender or indented shanks to grasp the rod barrel between the flow tube end & the reflective end plate, & rotate the rod until both back-reflections are in a horizontal plane. Now rotate & translate the head in a horizontal plane until the back-reflections are parallel to the input: if you obtain Fig. 1b rather than Fig. 1a, repeat this paragraph, rotating the rod 180° about its own axis.

Rotate & translate the head in a horizontal plane until you can again see both back-reflections. Use the spanner to retighten the rod nuts, checking frequently to see if the reflections have rotated: the rod probably will rotate during this procedure, & you should then slightly back off the nut you have been working on, & start tightening the other one. After the rod nuts are tight, blow out any wear particles with a filtered duster & check the rod faces again.

Put the head back on its slide & restore the flow tube to its recesses. Attach the side that was earlier removed, while forcing it toward the upper (white) insulating plate. Remount the head in the chassis, leaving the mounting screws just sufficiently loose that the upper (white) insulating plate can slide relative to the lower (green or black) one. Install the lamps (but not their connectors). Reattach the plumbing connectors (make sure that the clips are fully retained) & do steps (1)-(4) of subsection 3-2 of the IOMM; specifically check the rod faces to make sure they stay dry. Reattach the trigger xfmr lead. The head is now ready for realignment.

E. Turning Optics Group

The following optics are subsumed under this heading (the -1441 lens is present only in some MY34's, while the other lenses are in the interstage telescope of each MY35):

Thin-Film Polarizer: 0060-2320

Max.-R Mirror (45°): 0060-2651

Coma-Free Negative Lens: 0060-1441

" " " " : 0060-1442

" " Positive " : 0060-1451

Inspection access to any of these parts is obvious. To remove any of these optics, first remove the whole mount from the optical baseplate; mechanical access to the optic is then obvious.

The -1441 "lens" must be mounted with the most-curved surface on the side with the most-parallel light (i.e. toward the incoming beam from the oscillator). The "polarizer" must be mounted so that the incident beam strikes the coated surface, which is against the mount (the uncoated side is against the padded retaining strips). The "mirrors" must be mounted so that the incident beam strikes the coated surface, which is against the retaining strips (the uncoated side is against the O ring in the body of the mount); since these units are used for beam steering, the retaining strips should be tightened only so far as to leave a gap of roughly 0.025" (0,64 mm) to the body. The interstage telescope lenses are treated just as those of the other telescope previously described.

F. Oscillator Head

The only optic (aside from the flashlamps: see subsection 1-2) in this subassembly is (MY32 or MY34):

*YAG Rod (0.25"):	0060-2461
*NEXT ASS'Y: Oscillator laser head:	0060-0031
or (MY33 or MY35):	
**YAG Rod (8.5 mm):	0060-2462
**NEXT ASSY: Big oscillator laser head:	0060-3781

The discussion of the amplifier head applies exactly to the oscillator head EXCEPT that the oscillator rod nut spanner (for the smaller rod) is Molectron p/n 0980-1770, & the orientation should be per Fig. 1(b) rather than Fig. 1(a). Before removal, however, first "boresight" the laser per the method discussed in G, below.

G. Other Oscillator Optics

This group comprises the following:

Max.-R Mirror ("Rear"):	0060-2653
Pockels Cell:	0060-3640
Thin-Film Polarizer:	0060-2320
1064-nm λ/4 Plate (std.):	0060-1111
" " " " (MY-SP):	0060-1116
MY-E Etalon (if present):	0060-4081
MY-SAM Etalon (if present):	0060-4082
Subcavity Optic, MY-SAM (if present):	0060-4083
Max.-R Mirror ("Front"):	0060-265x

Model	"x"
MY32-10	2
MY32-20	5
MY33	4
MY34-10	2
MY34-20	5
MY35	4

Inspection access to the mirrors is best attained by removing the hole plugs in the outer surfaces of the mirror mounts. The Pockels cell can be inspected through the rear mirror (which is on the umbilical end of the laser; the front mirror is on the output end). The polarizer can be inspected after one removes the lid from its housing. Access to the λ/4 plate & the etalons (if present) is attained by displacing or removing appropriate corrugated rubber "boots".

If any oscillator optic must be removed, first "boresight" the laser in order to facilitate the necessary subsequent

realignment. Remove the alignment-port plug from the rear (umbilical) panel of the laser chassis, by removing the three screws accessible from the inner side of the panel. Remove the hole plugs from the outer sides of the mirror mounts. Turn all charging power supply circuit breakers OFF & switch the SERVICE/NORMAL switch on the power console to SERVICE. Turn the KEY SWITCH to ON & open the shutters. Set up a He-Ne laser (preferably $\geq$ 2 mW TEM_{00}; preferably polarized; preferred polarization is horizontal, but vertical is acceptable) at the rear of the laser chassis (only if this is not practicable is it acceptable to set up at the front of the laser chassis, using the front alignment port) so that the beam is centered on both mirrors & so that the back-reflections from the coated mirror surfaces are aligned with the input beam as well as is practical (without changing the mirror adjustments!). The beam height is 2.50" (63,5 mm) above the top of the optical baseplate: two 3" x 5" file cards (or the metric equivalent) ruled at this height will be of considerable assistance in setting up the He-Ne laser (even better is a pair of alignment discs: Molectron p/n's 0980-1911 and 0980-1912). Most file cards have corners that are accurately 90° & hence can also be used to aid horizontal centering of the He-Ne laser beam. Place such a card with one edge flat on on the baseplate (i.e. horizontal), so that a vertical edge bisects the small hole above the large hole in the outer portion of a mirror mount: when the beam is bisected by the card, the beam is sufficiently well centered on that mirror. As your final step, note the positions at the He-Ne laser of the back-reflections from the coated mirror surfaces (you may have to dim the room lights & "chop" the He-Ne laser beam in front of the more distant mirror in order to identify that back-reflection); they should be close to being centered on the He-Ne beam, but probably will not be exactly centered (especially in the case of the more-distant mirror).

To remove any of these optics except the mirrors, first remove the whole mount from the optical baseplate. To remove a mirror, remove the mirror retainer from the mirror mount by removing the four screws at the ±45° directions. Mechanical access to the optic itself should now be obvious in all cases except that of the Pockels cell. To remove the latter from its mount, first remove the high voltage safety cage. Unsolder the leads that connect the Pockels cell terminals to the printed circuit board (PCB): you MUST suck the rosin "smoke" away from the cell (& laser) & out of the room, & considerable care should

be taken not to overheat the Pockels cell (the crystal inside which, is quite prone to breakage from thermal shock). The cell is held to the moveable plate of the mount by a clamp on the front of that plate. The clamp screws, two recessed, socket-head cap-screws, can be reached from above & loosened (do not remove) by a hex driver inserted between the plate & the PCB. Disassembly of the cell itself, except by the original vendor, is not at all recommended, for a number of reasons.

The "etalon" has a preferred "yaw" orientation & the "λ/4 plate" has preferred rotational orientation about its axis, but these are determined during realignment & need not be considered during physical replacement, per se. The "mirrors" have their coated surfaces facing the laser rod; if you do not retain the original "roll" rotational orientations of the mirrors, realignment will probably no longer be relatively trivial. The beam exiting the oscillator comes from the coated surfact of the "polarizer", which surface should be against the body of the mount (the uncoated face is against the padded retaining strips). The "Pockels cell" must have its terminals vertical & horizontal (except that cells having a fiducial mark must have that horizontal), & next to the PWB terminals to which they are wired; which end of the cell goes into the clamp is indicated by an arrow or, if the arrow is missing, can only be determined by reference to the isogyre pattern (see subsection 3-2B). Initially, then, pick an end to clamp (lightly!), BUT (if the arrow is missing) DO NOT SOLDER the cell into the circuit, nor restore the high voltage safety cage.

3-2 OPTICAL ALIGNMENT

This alignment procedure assumes that you have "boresighted" the laser per 3-1G, prior to removing any oscillator components or if the oscillator needs realignment for some other reason, & that any optics removed per 3-1E,F,G have been physically replaced (i.e. without any attempt at realignment); if this is not the case, refer also to 970292. The procedure assumes that the laser is not aligned at all: you should enter it at the earliest step that is relevant to your needs, and do every step (as directed) thereafter. However, if a step refers to an adjustment that you know (believe) to have retained correct alignment, omit (defer) changing that adjustment!

Refer to the cleanliness precautions of p. 3-1, above, with which this procedure assumes you are familiar. IOMM subsection 3-4 describes the IR card, IR viewer, power meters,

& wedged fused silica flat; the rocket red paper is described on IOMM pp. 3-8,9.

A. Initial Setup

1) Minor Mirror/Aperture "Tweaking" Only.

If you are merely doing minor oscillator alignment to reattain a fully symmetrical beam profile, turn on the laser (to the proper state) by doing the following steps of 970270: (2)-(4), (6), (7), (12)-(14), & that part of (21) preceding the word, "Tweak". Determine, by finger pressure on the mirror & aperture snouts, what minor adjustment(s) will recover the pattern of step (23), and do them. Moving the aperture, or front (output-end) mirror, tends to translate the beam; moving the rear (umbilical-end) mirror tends to change the beam direction.

2) Polarizer Reorientation Only

The thin-film polarizer is sensitive to atmospheric relative humidity, which can effect a change in the polarizer's operating angle (c.f. Fig. 2). This in turn affects MY-Series laser performance: if T_S becomes too large, the Q switch (Pockels cell plus polarizer) will no longer hold off lasing at high pump levels, and the short-pulse energy (especially in the harmonics) and stability suffer, although the long-pulse performance remains essentially unchanged; if T_P becomes too small, the polarizer "looks" like an intracavity loss, and the short-pulse and long-pulse energy outputs both suffer (but holdoff and stability do not). To set the polarizers to their new operating angle, first remove the second polarizer mount, plus dust boxes, beam tubes, etc., as required to allow the output beam from the oscillator polarizer to exit the laser chassis without being turned or blocked. Turn the laser on (to the proper state) by doing the following steps of 970270: (2)-(4), (6), (7) & (12)-(14); then proceed with 970270, starting with step (24).

3) General Case

If you intend doing general oscillator alignment or have had to replace the amplifier, remove from the IR beam line: the amplifier; any ovens & beam splitters or reflectors; & the beam dump. If you have replaced any SHG-related optics inside the harmonics box, remove

any optics associated with THG or FHG from the green beam line. Do the following steps of 970270: (2)-(5). Put the SERVICE/NORMAL switch in SERVICE position; the control panel lamps should go out. Rock the SHUTTER switch to OPEN position: the shutter should open & the SHUTTER switch & SHUTTER OPEN lamps (2) should light up. Rock the SHUTTER switch to CLOSE: the shutter should close, & the shutter-related lamps should go out. Open the shutter again.

B. Oscillator He-Ne Alignment

NOTE: The philosophy of steps (1) through (6) is to start alignment with the mirror nearest the He-Ne laser & proceed in order through the components, ending with the component furthest from the He-Ne laser. If the He-Ne laser is at the front of the YAG laser chassis, do these 6 steps in reverse order (except do 2 before 3).

1) Adjust the rear mirror to reattain the retroreflection observed in 3-1G (the rear mirror is at the umbilical end of the laser; the front mirror is at the output end).

2) Remove the aperture ass'y. Refer to Fig. 3. If the He-Ne laser used in 3-1G is not polarized, and if it is at the rear of the YAG laser chassis, install the correctly oriented "polarizer" between the He-Ne laser & the rear YAG oscillator mirror. If the He-Ne laser is at the front of the YAG laser chassis, whether or not it is polarized, install the correctly oriented "polarizer" between the YAG laser's thin-film polarizer & the Pockels cell. Install & correctly orient the "analyzer" between the Pockels cell & the viewing screen, which latter can be a cut (NOT TORN!) strip of a file card positioned at any convenient location. Put a sheet of lens tissue or other partial diffuser between the "polarizer" (if any) & the Pockels cell: the scattered-light pattern will show a set of concentric dark rings centered on a dark cross, & the center of this so-called isogyre pattern will be offset angularly from the mechanical centerline of the Pockels cell. If this offset is in a horizontal plane, skip to step (3); if it is in a vertical plane, remove the Pockels cell, turn it end-for-end (& rotate it 90° about its centerline), & remount it per the precepts of 3-1G.

3) Adjust the Pockels cell clamp to be as tight as possible WITHOUT LIGHTENING THE CENTER OF THE CROSS; this will not be very tight. Adjust the pitch & yaw of the Pockels cell mount so that the cross is centered on the He-Ne direct beam, which will appear as a brighter spot than the scattered-light background. If the Pockels cell is now not reasonably centered on the beam (albeit at about a 3^{o} angle), move the whole Pockels cell ass'y transversely & then retweak the pitch & yaw adjustments. Remove the "polarizer", "analyzer", diffuser, & viewing screen. Finally, resolder the connections between the Pockels cell & the PCB, taking the precautions of 3-1G to prevent contamination & thermal shock, & then reinstall the high voltage safety cage. Reinstall the aperture ass'y & center the aperture on the He-Ne beam.

4) Remove the beam tubes from the oscillator laser head; adjust the head's orientation & position per Fig. 4. Replace the beam tubes (adjust the beam tube mount if necessary to ensure that the beam tubes are reasonably centered on the He-Ne beam).

5) The waveplate mount should be adjusted about the vertical axis so that the back reflection is 0.56^{o} $\pm 0.14^{o}$ from the input beam. (With the He-Ne laser at the rear of the YAG laser chassis, this corresponds to a separation at the aperture of 0.25"±0.06" or 6,35 mm ± 1,6 mm). IF, AND ONLY IF, this is a new (replacement) waveplate: rotate the knurled adjustment so as to maximize the intensity at the He-Ne laser of the back-reflection from the coated surface of the more-distant mirror.

6) Adjust the front mirror to reattain the retroreflection observed in 3-1G. Close the shutters & put the SERVICE/NORMAL switch in NORMAL position.

C. System Self-Alignment

Follow 970270, starting with step (6).

D. Alignment of MY-E or MY-SP or MY-SAM

These options also are covered in 970270; refer to the summary on p. 1 of that procedure to locate the specific steps & pages. However, if the basic laser (exclusive of the option) is misaligned, it may well be necessary to remove the option, align the basic system, & reintegrate the option.

E. Pulse-Duration Adjustment

Follow 970305.

F. Adjustment of Second SHG (Option)

If your system has the MY-2SH option, which provides an additional green output by doubling the residual IR from the first frequency-doubler, then procedure 970270 is not complete for your system after step (42). Whenever 970270 calls for removal of "the" SHG oven and/or splitter (plus the additional waveplates--if present, see below--A/R). If you also have a THG section, you also must take care to have the correct output window in the harmonics box for whichever of the two wavelengths you are using at any given time.

If your first doubler is Type I (optional Model # MY532-1), things are quite straightforward: merely repeat step (72), EXCEPT do not adjust anything except the oven tilt (unless the second doubler is Type II, in which case there is a second $\lambda/2$ plate, just before the second SHG oven, that must also be optimized). If the first doubler is Type II (standard model # MY532-2), then life is more complicated.

Type-II doubling of 1064-nm radiation in KD*P is ~40% more efficient than Type-I, but has the disadvantage that the residual IR is elliptically polarized. The ellipse axes are $\pm 45^{\circ}$ from vertical & horizontal, but the eccentricity depends on the exact retardation introduced by the crystal. Fortunately, however, any elliptically polarized beam may be converted to any desired linearly polarized beam with at most two retardation plates: one half-wave, & one quarter-wave; see B. Rossi, Optics (Addison-Wesley, Reading MA, 1957) pp. 284-285. One uses the $\lambda/4$ plate to convert elliptical polarization to linear, & then the $\lambda/2$ plate to reorient the polarization plane. The additional equipment required is an (analyzing) high-power polarizer (air-spaced single-escape-window Glan-Taylor or equivalent), & the following steps must be performed immediately after step (72).

72.1) With the shutter closed, install the $\lambda/4$ plate in the first available position along the IR beam line after the existing dichroic. Install/position the analyzing polarizer further "downstream" (moving the beam dump A/R); if you don't have one, skip to step (72.7). Turn the amplifier charging

supply circuit breaker OFF, & switch the Q SWITCH rotary switch to LONG.

72.2) Ensure that the polarizer's rejection port (escape window) is oriented in the quadrant that points down & away from you, & that the rejected beam cannot strike anything in that quadrant that might be vulnerable. Open the shutter. Ensure that the beam is within the acceptance angle of the polarizer, for all orientations of the latter (within the designated quadrant). Set the axes of the $\lambda/4$ plate to $\sim 45^{\circ}$ from horizontal/vertical.

72.3 Set the polarizer for maximum throughput (minimum rejection).

72.4) Rotate the $\lambda/4$ plate slightly (guess a direction) and redo step (72.3). If the throughput is now higher (rejection lower), repeat this step (72.4), rotating the $\lambda/4$ plate in the same direction as before; otherwise, repeat this step (72.4), but rotate the $\lambda/4$ plate in the opposite direction from that of the previous trial. You are looking for that combination of $\lambda/4$ plate & polarizer settings that provides the absolute maximum throughput (absolute minimum rejection); when you have found it, proceed to step (72.5).

72.5 Turn the amplifier charging supply circuit breaker ON, wait $\sim$10 sec., and repeat steps (72.3) & (72.4). The thermally induced birefringence in the amplifier probably will yield a slightly different combination of settings. When you have found the optimum, proceed to step (72.6).

72.6 Set the Q SWITCH rotary switch to INT, wait $\sim$10 sec., and repeat steps (72.3) & (72.4). Once again the optimum combination of settings may be slightly different; when you have found it, proceed to step (72.7).

72.7 With the shutter closed, install the second 1064-nm $\lambda/2$ plate in the next available position along the IR beam line after the $\lambda/4$ plate. Install the second SHG oven, the second pair of dichroics, and the 532-nm $\lambda/2$ plate (if any); move the beam dump A/R. Turn the amplifier charging supply circuit breaker OFF, and switch the Q SWITCH rotary switch to LONG. Remove the analyzing polarizer.

72.8) Open the shutter. Ensure that the back-reflection from the second IR λ/2 plate is off-axis, and that the oven & splitters are well aligned. Turn the amplifier charging supply circuit breaker ON, & set the Q SWITCH rotary switch to INT. Maximize the (second) green output by adjusting the (second) oven tilt & the (second) IR λ/2 plate rotation. If you skipped the steps (72.2)-(72-6), proceed to step (72.9); otherwise, you may (at your option) return to step (73) of 970270.

72.9) Rotate the λ/4 plate setting slightly (guess a direction) & then adjust the (second) IR λ/2 plate for maximum green power. Continue this process (in the direction that gives an improvement) until the absolute maximum has been attained. Return to step (73) of 970270.

Molectron MY Series Nd:YAG Lasers

SECTION IV

ELECTRICAL/ELECTRONIC SERVICING

4-1 ELECTRICAL/ELECTRONIC OVERVIEW

The power console (see Fig. 6) contains all of the electrical & electronic components & subassemblies not required to be in the laser chassis or remote pendant. Within the power console, the power distribution chassis (PDC) contains most of the control & interlock relays that switch the prime power (120/280Y VAC) & secondary power (28 VDC, generated inside the PDC) to the various subassemblies as required. Also within the PDC is the oven controller card, which senses & controls the temperature of up to three of the optional etalon & harmonic-crystal ovens in the laser chassis.

The charging power supplies energize the capacitors of the pulse-forming networks, which latter consist of capacitors, inductors, & SCR-based lamp flasher switches to apply pulses having the proper temporal shape to the flashlamps. The charging power supplies feature high efficiency ($\gtrsim$ 85%), good voltage regulation (± 0.5% or better), low noise (virtually inaudible 6-kHz inverters), & a "constant-power" capacitor-charging waveform. The simmer supplies provide a few tens of mA through the flashlamps in order to continuously maintain an arc therein; this "simmered" operation yields higher laser efficiency, longer lamp life, longer life for the other components in the laser head pump cavity, & improved shot-to-shot laser output reproducibility. The simmer supplies also have a section that ignites the lamps in the first place, and automatically reignites the lamps in case of arc "blow-out" by the PFN discharge.

The power console also contains other subassemblies and components that are accessible through the rear door and/or the side panels, rather than from the front. Many of these have cooling-related functions. The fans provide forced-convection cooling of the PFN chassis & the various power supplies. The pump motor propels clean, deionized water through the secondary side of the water-to-water heat exchanger & the rest of the closed-cycle cooling loop, while the primary side of the heat exchanger uses tapwater or the output of an external water-to-air heat exchanger; each side of the water-to-water heat exchanger has a flow interlock switch, and that heat exchanger also has a thermal interlock switch. The events counter board counts and displays a submultiple of the accumulated oscillator flashlamp firings. The Pockels cell high voltage supply provides a programmed voltage waveform to the Pockels cell driver & the Pockels cell.

In the laser chassis we find all of the high-speed electronics, such as the Pockels cell driver and portions of the main control card; the latter provides all of the system timing signals. This chassis also has all of the input/output signal connectors. Finally, this chassis contains a number of terminal discrete components that are controlled by sub-assemblies in the power console. The remote control pendant is attached through a long cable to the laser chassis to enable the laser user to control some of the laser functions from the vicinity of the setup where the laser's output is used.

The shutter circuit & the start/stop circuit involve interlocking functions as well as control functions, and hence extend through several major subassemblies. For this reason we discuss these circuits separately rather than as portions of those subassemblies.

Molectron's test procedure for this unit is 970298.

We will be using a number of initials hereinafter:

CPS	charging power supply
EC	electronics cabinet
LC	laser chassis
mcc	main control card
PDC	power distribution chassis
PFN	P.F.N. Chassis
RCP	remote control pendant
SPS	simmer power supply

4-2 POWER DISTRIBUTION CHASSIS

Ref: 060011, Power Distribution Chassis Wiring Diagram.
See also: subsections 4-7, 8.

A. Power-Distribution Functions

Prime power for this series is 120/208Y VAC, 50 Hz or 60 Hz (the only component that must be changed when the frequency is changed, is the pump motor). This prime power, whether derived from the wall plug or from the secondary of a power transformer, is passed through fuses or circuit breakers to the areas listed.

DANGER!

PRIME POWER CAN PROVIDE A
LETHAL ELECTRICAL SHOCK!

ΦA passes (on black wiring) through fuse F1 & the key switch (LC:S3) to actuate relay K1, which enables the rest of the system, & lamp DS1. ΦA also passes through F2 & K1 to power the 28-VDC secondary power supply (A1), the oven controller (A2), & the power console fans (EC:B1,B2). Finally ΦA passes through F3 & power relay K4 (see below).

ΦB passes (on red wiring) through circuit breader CB1 & power relay K2 to the pump motor (at the bottom of the power console; EC:B3), & also through F4 & power relay K4. ΦC passes (on blue wiring) through F5 & K4.

On the "load" side of K4, all three phases pass to the charging power supplies (except that only ΦC goes to the MY32/34-10 osc. CPS). In addition, ΦA actuates K7 (which supplies required contact closures to the CPS's), & passes through F6 to provide power to the mcc (LC:A6) &, via LC:A6K1, to actuate time-delay relay K5 (which enables the shutter circuitry).

The 28-VDC secondary power is used throughout the shutter & start/stop circuitry (q.v.), & also energizes the following: Pockels cell HV power supply (EC:A1); simmer power supply or supplies PFN:A7,A8, except PFN:A5,A6 in some of the earlier s/n's.

B. Oven Controller Card

Reference: 060028, Oven Controller Ass'y
060337, YAG Oven Controller Schematic

The oven controller is a single printed circuit board residing in the power distribution chassis. Its purpose is to closely regulate the crystal/etalon temperature at a preset value sufficiently above normal ambient for good control. The oven controller will serve three independent ovens.

The board is powered by the ΦA AC, which energizes two power supplies. A linear "brute-force" supply provides power for the heating elements in each oven, and a potted "brick" supply provides the necessary ±15 VDC needed to activate the on-board circuitry. The servo uses a thermistor pair located within the oven, in one leg of an

operational amplifier wired as a voltage comparator. When the thermistor pair drops the voltage level below a predetermined threshold, the op amp's output will drive a power Darlington transistor into saturation, activating the oven heating elements.

Molectron's test procedure for this unit is 97072.

4-3 CHARGING POWER SUPPLIES

Reference: Drawings 060151 thru 060165

The capacitance of the pulse-forming network (PFN) that drives a pair of flashlamps (oscillator or amplifier) is charged along a "constant power" curve (600 J/s, 1200 J/s, or 2400 J/s) to the set point, at which the energy is then held within ± 1% until discharge. The supplies used are highly efficient, and the noise from the 6-kHz inverters is barely audible. The supplies are protected against output short circuits & brief output open circuits (defined as a few seconds not connected to a capacitance of at least 1 μF), & each contains the capacitor-dump relay & resistors to "safe" the capacitance of the associated PFN. The 1200-J/s supplies also have an internal fuse that blows if only one or two of the three AC phases is present.

The supplies should not be cycled on & off repeatedly (i.e. should not have AC prime power removed & reapplied repeatedly), in order to avoid burn-out of the capacitor-dump circuitry. Also, the absolute minimum output is about 500 V (absolute maximum is about 2000 V):

DANGER!

ANY CHARGING POWER SUPPLY CAN
PROVIDE A LETHAL ELECTRICAL SHOCK!

Servicing is usually by replacement.

4-4 PFN CHASSIS

Reference: 060012, PFN Chassis Wiring Diagram
060023, PFN Ass'y

For each pair of flashlamps, this chassis contains: the pulse-forming network (PFN); the Lamp Flasher & Clamp Diode ass'ies (discussed in 4-4A below, with the PFN's proper); & a simmer power supply. The pick-off coil for the shots counter (described in 4-5B below) is also located here.

Molectron MY Series Nd:YAG Lasers

A. Pulse-Forming Network(s)

Reference: 060015, Lamp Flasher Switch Ass'y
060061, Lamp Flasher Switch Schematic
060350, Diode Clamp Ass'y & Schematic

The oscillator flashlamps are driven (in series) by the high-current discharge loop C1/A2/L1, & the amp. lamps are driven similarly by C2/A3/L2; the discharge waveforms may be modified by A9 or A10. The capacitor/inductor combinations are designed to provide a current waveform through the lamps that nominally approximates a critically damped half-sinusoid, roughly 200μs wide at the 10% points, at full input (at less than full input, the waveform will tend to be overdamped). In case of faults or tolerance combinations that would allow under-damping, the avalanche diodes of A9 or A10 prevent significant voltage reversal. Note well that the lamps are not ohmic loads (for current ≳5 A, voltage across lamp is proportional to square root of current through lamp) & that the lamp impedance is typically less than 1 Ω near the current peak. The latter fact explains why a silver-filled grease (Chomerics 4220 or equiv.) must be used in all bolted connections: the total impedance of all connections in the high-current loop must be very much less than 1 Ω!

DANGER!

EACH PFN CAPACITOR STORES A LETHAL CHARGE, AND MUST BE VERIFIABLY DISCHARGED (e.g. with a "grounding stick") BEFORE ANY WORK IS PERFORMED IN THE PFN CHASSIS!

PFN discharge is controlled by the Lamp Flasher ass'y, which in turn is triggered by the main control card. However, discharge will not occur if the lamps are not 'simmering'.

B. Simmer Supplies

Reference: 060231, Simmer Power Supplies, Block Diagram

What is meant by "simmering" lamps is the passage of a DC current, in our case roughly 60 mA, through the lamps. This permits the PFN discharge to start in a relatively stable, already established arc, & to expand rapidly into the ion sheath surrounding that arc. This mode of operation provides the greatest reproducibility and, because it reduces electrode sputtering & discharge UV radiation, also provides the longest lamp life & greatest

laser efficiency of any of the possible modes of operation.

The simmer power supply used in these systems actually consists of two power supplies. One of these provides roughly 60 mADC at roughly 350 VDC to a pair of lamps in series, to maintain "simmer" conditions. The other supply is used, in conjunction with a small capacitor-discharge circuit that drives the primary of a trigger transformer (LC:T1 or LC:T2), to "ignite" the lamps whenever a sensing circuit determines that no arc exists (i.e. at initial system turn-on or if the PFN discharge "blows out" the arc). This second supply is called the auto-ignition section, & applies a relatively high voltage (1600 VDC or more) to the lamps as long as they have high (open-circuit) impedance, while the trigger section attempts to create an ionization path in the gas of the lamps. The secondary of the trigger transformer pulses the metal parts of the laser head to roughly 20 KV for roughly 1 µs at a 30-Hz rate until simmer is established (usually only one pulse is required). Only negligile current can be provided by the secondary of the trigger transformer, but a person touching the laser head during ignition will feel a definite electrical shock.

The quickest way to tell whether the lamps are simmering (if they are not flashing; if they <u>are</u> flashing at the correct repetition rate, they <u>must</u> be simmering) is to turn off the CPS circuit breaker(s) & then dim the room lighting. When the lamps are simmering, a pale lavender glow will be seen (faintly) through the lamp connector insulators.

Servicing is usually by replacement.

4-5 REMAINDER OF POWER CONSOLE

Reference: 060393 Elec. Cab. Baseplate Wire Diagram

Various subass'ies are attached to the frame and/or baseplate of the electronics cabinet, as detailed below.

A. <u>Cooling-Related Functions</u>

Reference: 060026, Cooler Ass'y

A pair of fans, exhausting through the louvers of the rear door, pull air through the air-filter ass'y at the bottom front of the power console & then through the various chassis'. The laser should not <u>routinely</u> be operated with any panels removed from the power console, since this

distorts the airflow & can cause overheating damage eventually. During service, one may operate with access panels off as may be required, except that extensive long-term continuous operation with panels off should be avoided as much as practical.

The laser head(s) & beam dump are cooled with recirculated filtered deionized (DI) water, which is itself cooled by the tap water in a water-to-water heat exchanger. If the precepts of IOMM Section IV, Maintenance, are observed, service should not be required, with the following possible exception. The DI water loop is closed-cycle, but not hermetically sealed: it is unlikely, but possible, that algae may start to grow in this plumbing. If this happens, clean (or, if necessary, replace) the affected parts; flush the DI water loop with detergent solution, then clean water, then several changes of DI water; refill the system with distilled or organic-free DI water to which an appropriate amount of commercial algicide (not copper-based!) or "chlorine" bleach (dilute aqueous solution of sodium hypochlorite, NaClO) has been added. The additive will somewhat accelerate electroytic corrosion & will shorten the life of the DI cartridge, however.

B. Events Counter Card

Reference: 060018 Events Counter Ass'y
060067 Schematic, Events Counter

The events counter card is a single printed circuit board residing in or near the PFN chassis (depending on s/n). Its purpose is to energize the events counter, proper, in order to record a submultiple of the number of laser pulses, thereby keeping track of lamp life.

Power for on-board logic is supplied from the +28 volts DC secondary power supply, reduced and regulated to +12 VDC by VR1. The input to the counter is from a small toroid core attached to the return side of the osc. pulse-forming network. When the lamps fire, a current spike will saturate Q1, driving its collector low. Once the lamp current returns to zero, Q1 comes out of saturation, returning its collector high. On the falling edge of Q1's collector output, counter U2 (set to divide by 100) is advanced. (U1A acts as a buffer/inverter.) Once the counter has advanced to 100, it produces a low-going pulse which is AC-coupled into U1B. Again, U1B acts as a buffer/inverter. U1B's output will go high, driving Q2 into saturation and advancing the mechanical shot counter. RC delays have been added to both U1 and U2 to prevent false counts on start up.

Molectron's test procedure for this unit is 970271.

C. Pockels Cell H.V. Supply

Reference: 060228, Pockels Cell HV Supply Schematic Block Diagram.

060357, Bertan HV Power Supply Schematic

This unit supplies 3580 ±72 VDC and 358 ± 7 VDC to the Pockels Cell Driver (LC:A9), plus a 3.58 ± 0.07 VDC monitor signal for service/diagnostic use. These voltages can be lowered by adjusting LC:R6, but this should not be done in normal operation. The HV output can supply up to 2 mADC; the other outputs have much lower current capability. The supply is programmed on & off by the mcc.

Service is normally by replacement. However, if field service is performed, the supply must be tested & set per procedure 970253, using the proper test fixture.

D. Slave Driver Circuit

Reference: 060411 Slave Driver Schematic
060414 Slave Board Ass'y

The amplifier flashlamp input power for the MY34-20 is more than can be provided by a single 1200-J/s supply, so two such are paralleled in "master/slave" configuration. The master supply enables/disables the slave supply via the slave-driver board.

4-6 LASER CHASSIS

Reference: 060019, Laser Chassis Wiring Diagram

This ass'y contains all of the fast-pulse & logic-level timing & control circuitry.

A. Main Control Card

Reference: 060123, Main Control Card Block Diagram
060475, Pulsed YAG System Timing
060521, Main Control Card Schematic

The main control card is located within the laser chassis and is responsible for all timing and control functions for the pulsed YAG. The board's function can be broken down into three major sections: digital, analog, and power

supplies. Detailed descriptions are given for each subsystem. The integrated circuits are identified by grid location on the board (1-12 horizontal, A-C vertical).

Digital (Reference Schematic 060521).
The lamp flash rate, as determined by service subpanel control switches and/or external signals, is controlled by A9, A10, and steering logic A11. When the PULSE RATE rotary switch is in the "INT" position, pin 8 of A9, a voltage-controlled oscillator, is driven low, thereby selecting timing resistors R12 and R27. R12 is used to trim the running frequency to 1.000 kHz (2.000 kHz) in the MY3X-10 (MY3X-20), respectively. This rate will be divided by A10 to produce a system rate of 10.00 Hz (20.00 Hz). With the PULSE RATE switch in the "VARIABLE" position, pin 8 of A9 is driven high, selecting resistors R11, R26, and the service subpanel rate adjustment pot. The adjustment rate is between 500 Hz (1 kHz) and 2 kHz (3 kHz). Again, A10 is used to divide by 100 for a system rate of 5 to 20 Hz (10 to 30 Hz). With the PULSE RATE switch in the "EXT" position, A10 and A9 are bypassed, with the signal at the "LAMP TRIGGER" input inverted and fed directly into the steering logic. Flash rate is driven directly from the external trigger rate on the rising edge of the trigger pulse. The output from the rate generation section is fed into the frequency validation section comprising a dual one-shot, A7, and steering logic A5. This section is designed to pass a frequency of 5-20 Hz (10-30 Hz). A negative-going pulse applied to pin 11 of A7 will produce* a 50-ms (33-ms) positive pulse on the "Q" output, pin 10, and a 50-ms (33-ms) negative pulse on "$\overline{Q}$", pin 9.

On the rising edge of $\overline{Q}$, pin 4 of A7 is triggered, producing a 150-ms (67-ms) pulse. This occurs at the time-out of the first section. If another pulse arrives at pin 11 of A7 within the next 150 ms (67 ms), it will be passed thru pin 10 of A7 and steering logic A5. If the pulse arrives later, pin 6 of A7 will have timed out and disabled pin 9 of A5. (It can be seen from the above description that the first pulse is used to "arm" pin 6 of A7.) If the pulses applied to pin 11 of A7 are less than 50 ms (33 ms) apart, pin 9 of A7 will constantly retrigger, thereby inhibiting an output signal.

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*The 4538 dual one-shot contains two independent timing sections. Each section produces a pulse of duration RC, determined by the values R & C of the resistor/capacitor combination connected between its timing pins (2 & 14).

The output (pin 10) of $\overline{A}5$ is then fed into pin 11 of $\overline{A}6$, a dual one-shot. $\overline{A}6$ is configured to activate (set) flip-flop $\overline{B}9$ (pin 8) and turn on the Pockels cell high voltage power supply**. The pulse width at pin 10 of $\overline{A}6$ is set at 250 µs. This allows the power supply to stabilize at the high-voltage setting before the Pockels cell is fired. When pin 10 of $\overline{A}6$ times out, pin 5 of $\overline{A}6$ is triggered to produce a 30-µs pulse. The "Q" output is used to drive sample-and-hold switches $\overline{B}12$. The "$\overline{Q}$" output also is applied thru $\overline{A}5$ (and also ANDed with turn-on signal T.O.***) to the system timing bus. This bus is shared with the oscillator/amplifier lamp timing/trigger circuits, and also the shutter control.

The output (pin 3) of $\overline{A}5$ is fed into dual one-shots $\overline{A}3$ and $\overline{A}4$. $\overline{A}3$ has been configured to provide variable time delays for the amplifier flashlamps. Pin 6 of $\overline{A}4$ has been configured as the delay for the oscillator lamps, with pin 10 of $\overline{A}4$ used as the shutter control. The output of each delay timer is fed thru ½ of a 556 dual timer wired as a current buffer/inverter. The output of the 556 is capacitively coupled to the gate of an SCR charge-dumping network. When the delay one-shot times out, a positive pulse is applied to the base of the SCR, discharging the .1-µF storage capacitor through the external flasher circuits located in the laser PFN chassis. The shutter control section, pin 10 of $\overline{A}4$, is designed to activate the shutter control relay K1 (thru Q8) and allow the shutters to open whenever a valid rate is detected. The one-shot will keep the shutter active approximately 300 ms after the last timing pulse. The pulse applied to the oscillator SCR is also fed to a buffer/inverter, $\overline{A}2$, and current source transistor Q10. The output pulse for Q10 is a positive-going pulse with an exponential decay. Output impedance is 50 Ω (Note: All timing delay one-shots are independently variable within a window. See drawing 060475). On the falling edge of the oscillator timing one-shot, $\overline{A}4$ pin 6, pin 5 of $\overline{A}3$ is triggered to produce a variable-width negative-going pulse, 130-350 µs wide, which is applied to the clock input of $\overline{B}7$ (pin 11). On the rising edge of the clock, a high is transferred to the "Q" output (pin 13), if the reset (pin 10) is high.

** The Pockels cell power supply is controlled by the opto-coupler $\overline{C}9$. (When pin 9 of $\overline{C}8$ goes low, the opto-coupler is enabled and the supply turns on.)

*** The T.O. signal is used to inhibit all card functions until the on-card supplies have stabilized.

(In the "NORMAL" position of the remote pendant "Q SWITCH" rocker switch, this is always true; in the "SINGLE SHOT" position, a high is transferred thru pin 1 of B7 only when the "FIRE" button is pressed.) The pulse out of pin 13 of B7 is used to fire the avalanche-configured transistors Q5 and Q6, thereby firing the Pockels cell driver, and also to disable the Pockels cell power supply (after a slight delay). The avalanche transistors are used to generate a positive-going pulse, 8 volts in amplitude, with a t_r of approximately 3 ns and exponential decay. One pulse is delivered to the Pockels cell driver board and the other is output to the "Q-SWITCH SYNC" BNC. Output impedance is 50 ohms.

The Q-switch mode is determined by the service subpanel Q SWITCH rotary switch and controlled by B5. In the "INT" mode, the reset input (pin 4) of C8 is disabled, allowing C8 to trigger in the usual manner (on every laser pulse). When the switch is place in the "LONG" mode, C8 is inhibited from firing, thus disabling the Pockels cell. In the "EXT" position, the Pockels cell power supply is turned on & off exactly as in the "INT" mode; however, because the reset line (pin 4) for C8 is low, C8 does not transmitt the internally generated Q-switch trigger. Instead, the Q switch will fire upon the application of a positive-going pulse to the external Q-SWITCH TRIGGER INPUT through the wired-or connection, CR14 and CR15.

Analog Section

This section consists of buffer amplifiers A12, scaling resistors R1 and R2, sampling switches B12, and hold amplifier C12. During the 30-µs interval that A6 pin 7 is low, the oscillator or amplifier sampling switch B12 is closed, thus charging hold capacitor C64 to the voltage* level at the wiper of R1 or R2. C12 is a low-input-current device which drives the service-subpanel energy meter through R80. C69 provides meter damping.

Power Supplies

The Main Control Card contains two AC-energized power supplies, of +12 VDC & +90 VDC. The power for all digital logic is derived from the full-wave filtered supply consisting of T1, BR1, and 12-volt regulator VR1. The

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*This voltage is derived from a resistor divider network in the PFN chassis. There is a divider on each of the oscillator and amplifier sections, selectable from a switch on the service subpanel.

90-volt high voltage supply for the avalanche and SCR trigger circuits is derived from T2, BR2, and Zener regulators CR1-3.

Some Waveforms & Timings

In Table 4-1 the following conditions were in effect:

1. Laser on, with lamp charging supplies off, shutter closed.
2. 1-MΩ scope grounded to negative side of C5.
3. Remote pendant in "NORMAL" position.

-20 version timings shown in parentheses.

B. Pockels Cell Driver Card

Reference: 060017, Pockels Cell Criver Ass'y
060340, Pockels Cell Driver Schematic

This subass'y permits the Pockels cell to be charged by the Pockels cell HV supply, & then discharges it rapidly (∿7 ns std; ∿100 ns with MY-SAM or MY-SP) when commanded by the mcc. The driver is based on cascaded avalanche transistors, which must be specially selected & grouped (per procedure 970283): if one transistor fails, all must be replaced, so subass'y service normally will be by replacement.

During avalanche, a positive "spike", several ns long & roughly 300 V in amplitude, is generated at the base of Q1; at the anode of CR1 this waveform will be attenuated to roughly 150 V & stretched somewhat in duration. Trouble-shooting that involves looking at the input to this circuit should usually be performed with the Pockels cell HV supply disabled (closing the shutter is the easiest way to do this).

C. SAM Prelase Ass'y

Reference: 060531, SAM P.D. Schematic
060534, SAM P.D. Ass'y

In MY3x lasers with the MY-SAM accessory, in the process of attaining single-axial-mode oscillation it is desirable to derive the Pockels cell driver trigger from "prelasing" rather than from the internal clock & delays of the main control card. (Prelasing is weak, non-Q-switched lasing: see subsection 3-6 of the IOMM, & the relevant portion of 970270.) The prelase ass'y detects this prelasing & signals the main control card.

TEST POINT	WAVEFORM	PULSEWIDTH or FREQUENCY	ADJUSTMENT POTENTIONMETER	RATE SELECT	RATE ADJUST	EXTERNAL RATE INPUT	COMMENTS
$\overline{A}$9, Pin 13		1.000 kHz (2.000 kHz)	R12	INT	-	-	Sets internal system rate
$\overline{A}$7, Pin 10		45 ms (30 ms)	R10	INT	-	-	Sets high freq. limit
$\overline{A}$7, Pin 6		160 ms (66 ms)	R9	EXT	-	4Hz @5V	Sets lower freq. limit
$\overline{A}$9,, Pin 13		500 Hz (1.000 KHz)	R11	VAR	CCW		Trims lower rate limit
$\overline{A}$6, Pin 10		250 us	R8	INT	-	-	Set Pockels cell power supply turn-on delay
$\overline{A}$6, Pin 6		30 us	R7	INT	-	-	Sets analog sample window
$\overline{A}$3, Pin 10		270 us	R4	INT	-	-	Sets amplifier delay
$\overline{A}$4, Pin 6		300 us	R5	INT	-	-	Sets oscillator delay
$\overline{A}$3, Pin 10		170 us	R6	INT	-	-	Sets Pockels cell delay

Keys:

TABLE 4-1

Main Control Card Timings (Nominal!)

4-7 REMOTE CONTROL PENDANT

Reference: 060007, Remote Pendant Ass'y
060352, Control Pendant Wiring Diagram

S1 is part of the shutter circuit (q.v.), & has the somewhat special actuation function tabulated below. The rocker is spring-loaded to return to center from the OPEN & CLOSE positions (unless held, of course), but the contact closures indicated are maintained as long as the rocker is in the indicated position (i.e. the closures are not truly "momentary").

Rocker Position	Shorted Contacts	Open Contacts
OPEN	2-3, 5-6*	1,4
center	2-3, 5-4	1,6*
CLOSE	2-1, 5-4	3,6*

*6 is externally shorted to 2, remember.

Lamp DS1 is located under the rocker, & access for replacement is obtained by gently gripping the rocker (not its bezel!) with a pair of pliers & pulling straight away from the face of the pendant.

4-8 SHUTTER CIRCUIT

Reference: 060389, Shutter Circuit
060423, Shutter Board Schematic

The shutter is actuated by a rotary solenoid (LC:L1) wired in parallel with a noise-suppression diode (LC:CR1). The solenoid is driven by a "hold-in" circuit (PDC:A3) that applies (relatively) high power for the stroke, which requires relatively high torque, but then only low power to provide the relatively low torque needed to maintain the solenoid in the energized position against the torque of the return spring.

When PDC:K6 is energized (see below), the hold-in circuit obtains 28 VDC either directly from PDC:S1, when that toggle switch is in SERVICE position (in which case no other part of the system can "see" 28 VDC), or else via PDC:S1/J1-P1/K5. The shutter constitutes the BRH-mandated "beam attenuator", J1 & P1 constitute the BRH-mandated "remote control connector", & time-delay relay K5 provides the BRH-mandated time interval between illumination of the BRH-mandated "laser radiation emission indicator" (comprising PDC:DS3 & LC:DS3, the ON lamps) & emission of accessible laser radiation.

When 28 VDC is available at RCP:S1-3 & PDC:K6-13, via either of the paths described in the preceding paragraph, the shutter can be opened (i.e. K6 can be actuated). When the SHUTTER switch (RCP:S1) is rocked to OPEN, its terminals 2-3-5-6 are shorted together, & voltage is applied to PDC:K6-1 (the coil) & PDC:K6-6; this actuates PDC:K6 (thereby applying voltage to PDC:K6-6 along an additional path, via PDC:K6-7) & illuminates the SHUTTER OPEN lamps (PDC:DS4, LC:DS4, & RCP:DS1). With the SHUTTER switch in the center position, 28 VDC is still present at RCP:S1-5 (but via PDC:K6 rather than directly), so PDC:K6 remains energized. When the SHUTTER switch is rocked to CLOSE, the 28-VDC path is opened at RCP:S1-3, & PDC:K6 disengages.

4-9 START/STOP CIRCUIT

Reference: 060391, Start/Stop Circuit

This circuit is composed of four (overlapping) sub-circuits, the wiring of each of which is color-coded. Violet-insulated wire goes to the personnel-safety access-interlock switches (PFN:S1; EC:S1,2,3; LC:S7,8; & LC:J1/P1); note that LC:J1/P1 constitute a (defeatable) safety interlock for the harmonics-box lid, as mandated by BRH "... for each portion of the protective housing which is designed to be removed or displaced during operation or maintenance, if removal or displacement of such portion of the protective housing could permit human access to laser or collateral radiation in excess of the accessible emission limits applicable...". Violet-insulated wire also goes to the thermal switch (EC:S3), which protects the system against damage from overheated coolant. Blue-insulated wire is associated with the coolant-flow sensors, EC:S1,2 -- the former for the city-water loop & the latter for the DI-water (closed cycle) loop. Blue-striped-white-insulated wire is associated with the circuitry that starts/stops DI water flow (@ PDC:K2), while violet-striped-white-insulated wire is associated with the circuitry that enables/disables prime power (@ PDC:K4).

Violet wire also goes to PDC:J1/P1, which constitute the BRH-mandated "remote control connector". PDC:P1 can be wired so as to disable either the shutter circuit (q.v.) or the whole system: in the latter case, whatever external circuitry is wired to this plug is part of the start/stop circuit's interlock subcircuit.

The start/stop circuit performs in the following way. First, the key switch (LC:S3, the BRH-mandated "key control") must be turned ON, which provides ΦA AC (via PDC:F1) to the

coil of PDC:K1. Actuation of PDC:K1 provides ΦA AC (via PDC:F2) to: PDC:DS1 (POWER) ; PDC:A1 (28 VDC supply); EC:B1,2 (fans); & PDC:A2 (oven controller). If toggle switch PDC:S1 is in NORMAL position, 28 VDC is provided to LC:DS1 (POWER) & various open-circuited relay & switch terminals; if also all of the switches in the interlock subcircuit are closed, then 28 VDC is provided to LC:DS2 (READY), & more open-circuited relay and switch terminals. The system is now ready to start, but it will not be harmed by deferring start-up indefinitely from this (or any preceding) condition. If the START pushbutton (LC:S2) is now held depressed (the city water is assumed to be off), power relay PDC:K2 is actuated, & ΦB AC drives the DI-water pump motor EC:B3 via PDC:CB1; however, no power is provided to any additional part of the system (although flow switch EC:S1 does close, neither side of it is "live"), & releasing the START push-button will return the system to its previous state. (This is the way to purge bubbles from the DI water loop without danger to personnel or the system.)

To actually start the system, the city water must be turned on, to a flow rate that actuates EC:S2, which will in turn energize PDC:DS2 (WATER). An excessive city water flow rate, or city water that is too cold,or excessive delay in completing the turn-on procedure, may cause dew on the laser rod(s) & consequent improper operation and/or damage; c.f. IOMM subsection 2-2. Now, as detailed below, attaining sufficient flow in the DI water loop will energize the remainder of the system.

As before, holding the START pushbutton (LC:S2) depressed will actuate power relay PDC:K2 & hence turn on pump motor EC:B3. This time, however, the city water flow has actuated EC:S2, & hence one side of EC:S1 now is "live". When the pump motor has attained sufficient speed for the DI water flow to actuate EC:S1, the following things happen, & the START push-button may be released. When EC:S1 actuates, 28 VDC is applied to LC:DS3 (ON; illumination of this lamp signals that the START pushbutton may be released) & to the coil of PDC:K3. Actuation of PDC:K3 applies 28 VDC to the coils of PDC:K4 (a power relay) & PDC:K8, which respectively distribute prime power & secondary power; see subsections 4-2A & 4-8. Actuation of PDC:K8 also applies 28 VDC to PDC:DS3 (ON) &, via the STOP switch (LC:S1), to the pump motor power relay (PDC:K2) coil, which was originally energized by pushing the START pushbutton (LC:S2).

The system will run (with the START pushbutton released) so long as all interlock functions (access, flow, temperature) are satisfied & the STOP pushbutton is not depressed. If now

the STOP pushbutton is held depressed or an interlock function definitely fails, 28 VDC is removed from the coil of PDC:K2, which in turn removes ΦB from the pump motor, which coasts to a halt. After flow switch EC:S1 has disengaged, the system shuts itself down (if this is a deliberate shutdown, the STOP pushbutton can be released after the ON lamps extinguish); see also the next paragraph.

If the STOP pushbutton is briefly depressed or an interlock function briefly fails (e.g. due to a bubble in a flow loop), so that pump motor relay PDC:K2 re-engages before flow switch EC:S1 disengages, there will be a partial shutdown. In this case PDC:K4 & PDC:K8 will disengage & remain that way (as will PDC:K7, in turn), but PDC:K3 will re-engages. In this case the pump motor & ON lamps will be energized, but the various power supplies (except 28 VDC) will not. The system can now be fully turned on or turned off by the START or STOP pushbutton, respectively.

SECTION V

FIGURES, DRAWINGS, & PROCEDURES

"Released" drawings have numbers starting with 060. "Released" procedures have numbers starting with 970. All "released" documents are under ECO control, & so this manual revision has the latest document revisions that are applicable to your system as of its date of manufacture. This manual copy will not be updated after delivery to you (except to correct any errors), unless your system is subsequently modified by Molectron in a manner not already covered by this version of the manual, in order to keep it accurate for your system.

Fig. 1a. AMPLIFIER ROD ORIENTATION CHECK. (TOP VIEW)

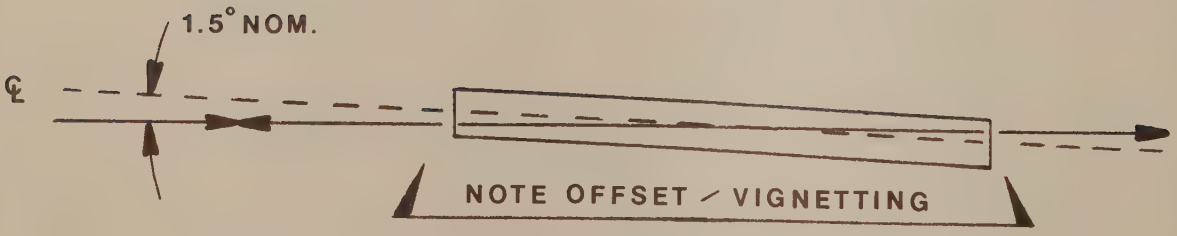
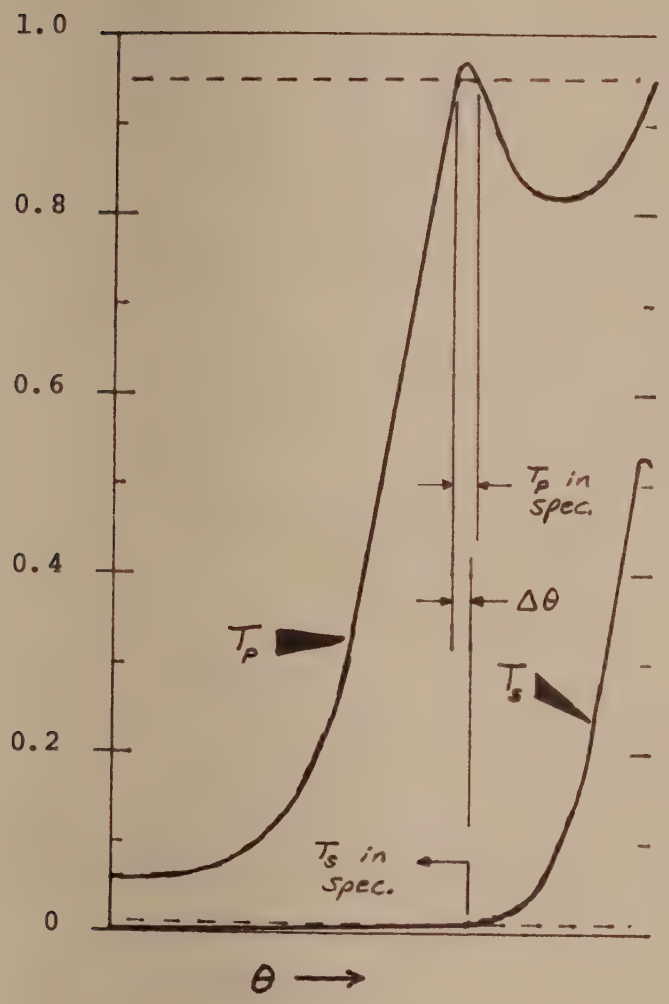


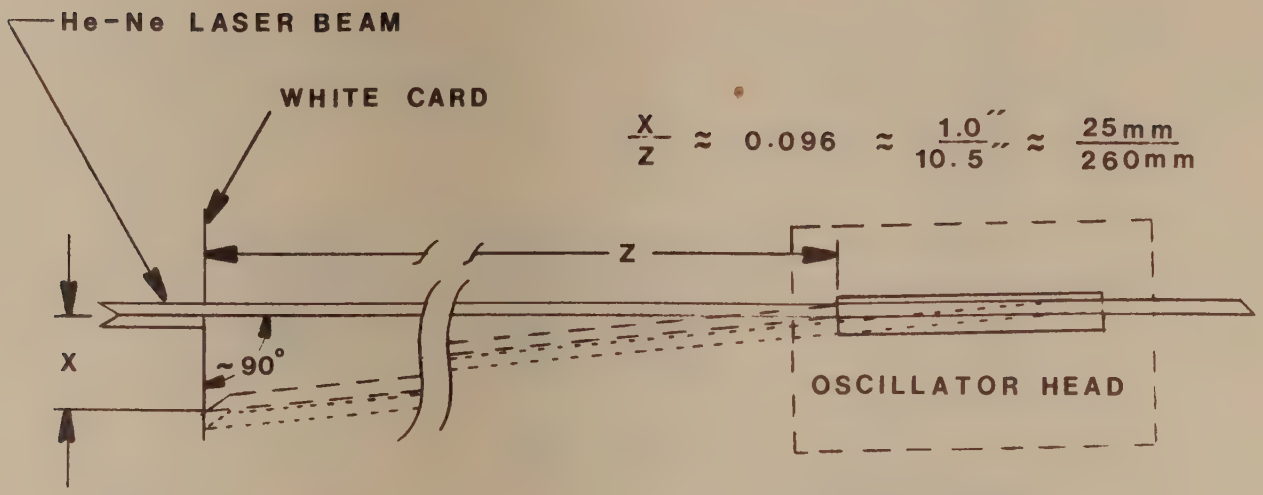
Fig. 1b. OSCILLATOR ROD ORIENTATION CHECK. (TOP VIEW)



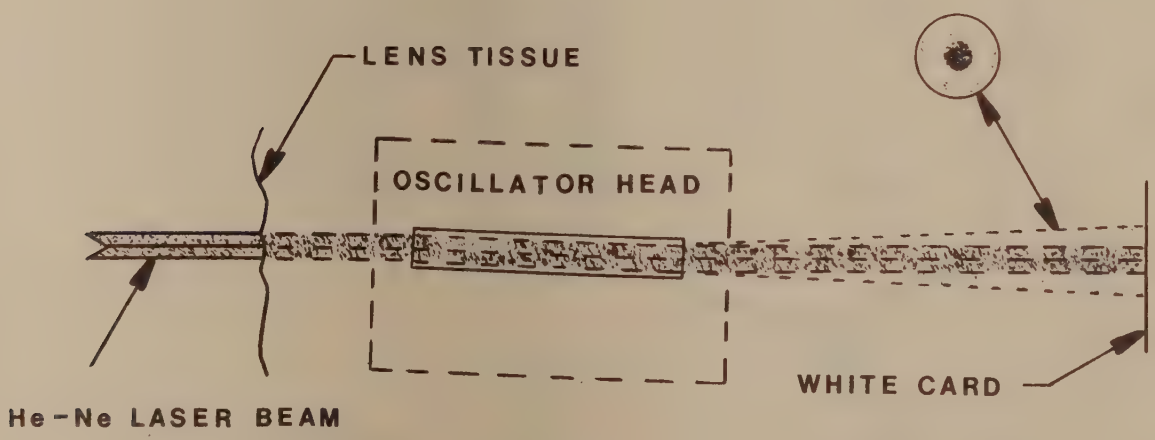
Operating range ($T_p \leq 0.95$, $T_s \leq 0.01$) is $\Delta\theta$, nominally centered @ $\theta = 56.5^{o}$.

Fig.2. Typical Thin-Film Polarizer Transmission Curves

Fig. 3. POCKELS CELL ORIENTATION CHECK

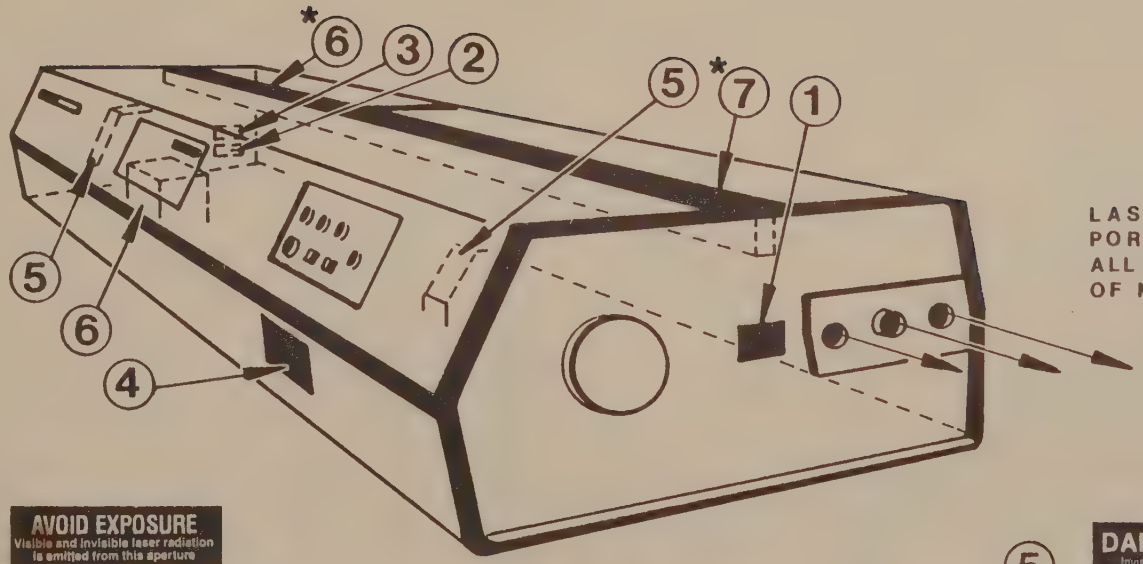


a] TILT CHECK [SET-UP VIEWED FROM ABOVE]



b] CENTERING CHECK

Fig. 4. OSCILLATOR LASER HEAD INSTALLATION



LASER OUTPUTS: ANY ONE PORT, ANY TWO PORTS, OR ALL THREE PORTS. SEE TEXT OF MANUAL.

① AVOID EXPOSURE
Visible and invisible laser radiation is emitted from this aperture

APERTURE LABEL

② This product complies with DHEW Radiation Performance Standards 21 CFR Chapter I, Subchapter J

CERTIFICATION LABEL

③ Molectron CORPORATION
177 NORTH WOLFE RD., SUNNYVALE, CA. MADE IN U.S.A.
MODEL NUMBER SERIAL NUMBER
MANUFACTURED: J.O NUMBER

IDENTIFICATION LABEL

④ DANGER
VISIBLE AND/OR INVISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
Max Average Power 20W
Max Energy Pulse: 1.5 J
Laser Medium: Nd YAG and or harmonics
Pulse Duration: Approx. 15ns or less
Principal Radiation 1064, 532, 355 and or 266nm
Consult Instruction Manual
CLASS IV LASER PRODUCT

WARNING LOGOTYPE MY32, MY34

⑤ DANGER
Invisible laser radiation when open
AVOID DIRECT EXPOSURE TO BEAM

⑥ DANGER
Visible and invisible laser radiation when open
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION

NONINTERLOCKED PROTECTIVE HOUSING LABELS

⑦ DANGER
Visible and invisible laser radiation when open
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION

DEFEATABLY INTERLOCKED PROTECTIVE HOUSING LABEL

* NOTE: LABELS 6 AND 7 POSITIONED ON FARSIDE OF BAR.

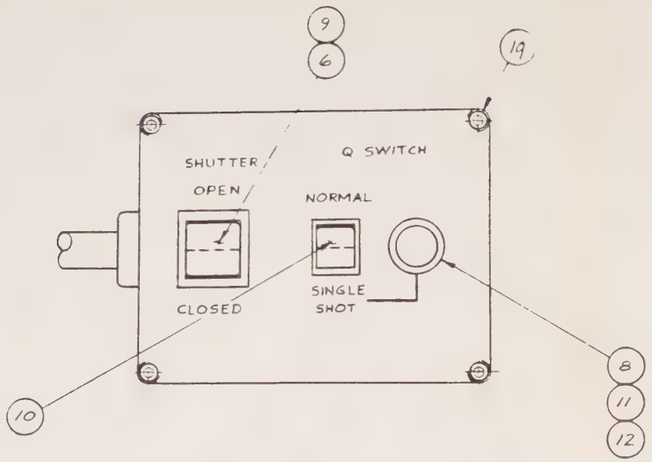
FIG.5 BRH WARNING LABELS

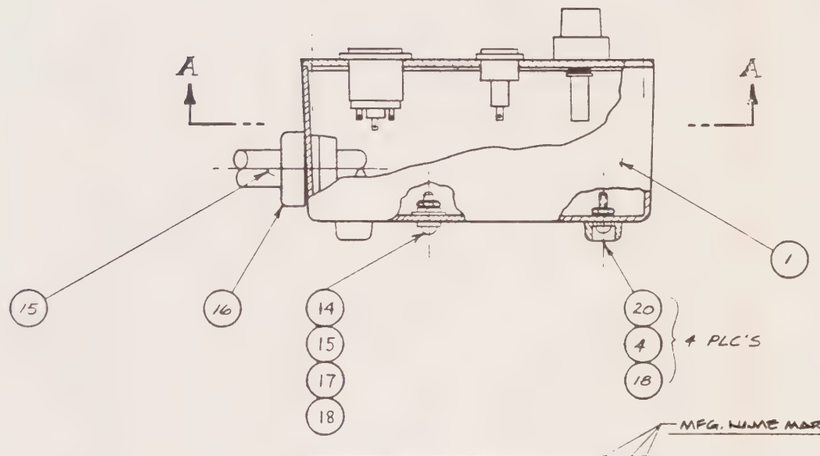
NOTES

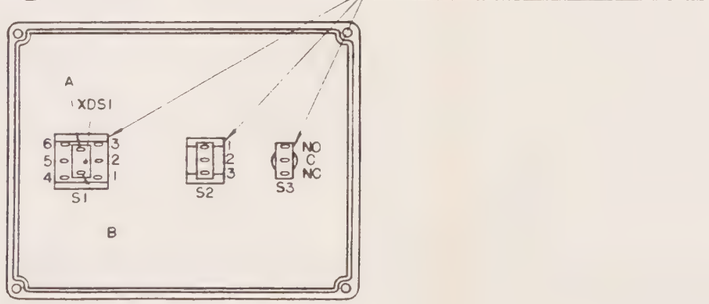
⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	PROD REL. ECO #1978 (FOR P/L ONLY)	3/16/79	WDF
B	ECO # 2042	9/[illegible]	[illegible]
C	ECO # 2119	11-5-79	[illegible]
D	ECO # 2230	3/7/80	WDF
E	ECO # 2447	10/[illegible]	WDF
F	ECO # 2908	[illegible]	WDF







SECTION A-A

NOTICE - PROPRIETARY INFORMATION
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-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
			1		060037	MYSX		

PARTS LIST

QTY	1
USED ON	MYSX
NEXT ASSY	060037
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± —— ANG ± —
.XXX ± —— FIN —— √
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH
1

DRAWN BY	G.L.C.M.
DATE	3/9/79
CHECKER	
APPROVED	
APPROVED	
CUSTOMER & SPEC	
CONTRACT NO.	
SIMILAR TO	

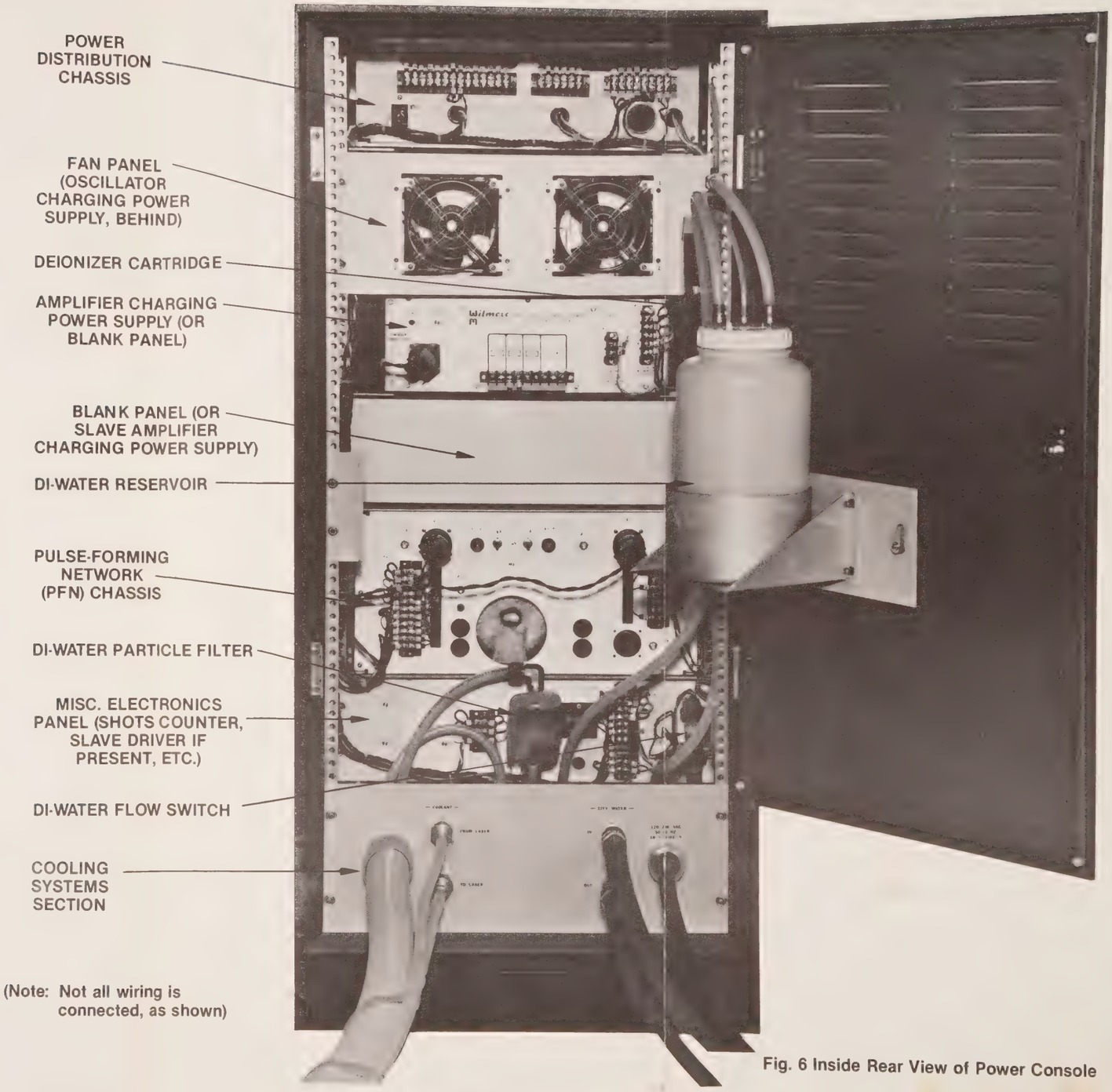
Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
REMOTE PENDANT ASSY

CODE IDENT NO	SIZE	DWG NO.	REV
34285	D	060007	F

SCALE 1:1 SHEET 1 OF 2

© R.SMITH GRAPHICS ACCUPRESS
REORDER NO. A-935


POWER DISTRIBUTION CHASSIS
FAN PANEL (OSCILLATOR CHARGING POWER SUPPLY, BEHIND)
DEIONIZER CARTRIDGE
AMPLIFIER CHARGING POWER SUPPLY (OR BLANK PANEL)
BLANK PANEL (OR SLAVE AMPLIFIER CHARGING POWER SUPPLY)
DI-WATER RESERVOIR
PULSE-FORMING NETWORK (PFN) CHASSIS
DI-WATER PARTICLE FILTER
MISC. ELECTRONICS PANEL (SHOTS COUNTER, SLAVE DRIVER IF PRESENT, ETC.)
DI-WATER FLOW SWITCH
COOLING SYSTEMS SECTION

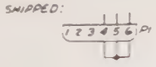
(Note: Not all wiring is connected, as shown)

Fig. 6 Inside Rear View of Power Console

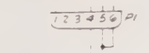
NOTES:

1. WIRE MATING PLUG P1 AS FOLLOWS:

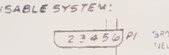
AS SHIPPED:



TO DISABLE SHUTTER:



TO DISABLE SYSTEM:



2. NO CONNECTION FOR MY32-10 & MY32-10 ONLY

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	PROD REL ECO #2122	10-23-79	[illegible]
B	ECO # 2157	12-8-79	WEF
C	ECO # 2177	12-27-79	WDF
D	ECO NO 2297	2-[illegible]-80	WDF

REFERENCE DESIGNATIONS		
FIRST	LAST	LETTER
A1	A3	---
-	-	-
B1	B1	---
K1	K1	---
S1	S4	---
-	-	---
T1	T1	---
V1	V8	---
P1	P1	---
-	-	---
K2	K6	K2, 4, 5
S2	S2	---
T2	T2	TB8
CR1	CR4	---
F1	F6	---
K7	K7	---

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QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

DRAWN BY	DATE 7/24/79	Molectron CORPORATION	177 E. WOLFE ROAD SUNNYVALE CALIFORNIA 94086 (408) 736-7661
CHECKER			
APPROVED		TITLE	POWER DISTRIBUTION CHASSIS WIRING DIAGRAM
APPROVED			
CUSTOMER & SPEC			
CONTRACT NO		CODE IDENT NO 34285	SIZE E
SIMILAR TO		DWG NO 060011	REV D
		SCALE NONE	SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC XX ± ——— ANG ± ———
XXX ± ——— FIN ——— ✓
BREAK ALL SHARP EDGES .005 - .020
MATERIAL SEE P/L OF ASS'Y DWG. 060021
FINISH

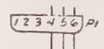
REF	QTY	USED ON	APPLICATION
060021	MY32	NEXT ASSY	

NOTES:

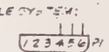
1. WIRE MATING PLUG P1 AS FOLLOWS:

AS SHIPPED:

TO DISABLE SHUTTER:



TO DISABLE CYD "EX":



2. ⚠ NO CONNECTION FOR MY32-10 & MY84-10 ONLY

REFERENCE DESIGNATIONS		
FIRST	LAST	OMITTED
A1	A3	---
---	---	---
CR1	CR2	---
J1	J9	---
DS1	DS4	---
F1	F2	---
J3	J4	---
K1	K3	---
P1	P1	---
---	---	---
R1	R9	R3,4,5
S1	S1	---
TB1	TB11	TB6
VR1	VR4	---
XF1	XF2	---
XV1	XV7	---

REVISIONS			
LTR	DESCRIPTION ECO	DATE	APPROVED
A	ECO # 2107		
B	ECO # 2		
C	ECO # 2		
D	ECO NO. 22397		

(EC) TB2-3 GND
(EC) TB2-1 NEUT
(BC) TB2-2 Ø B
(BC) TB1-1 } THERMOSTAT
(BC) TB1-2 }
(BC) TB1-10 NO. } H.E. FLOW SWITCH
(BC) TB1-11 COM }

QUANTITY	PART NUMBER	DESCRIPTION	REF DES

PARTS LIST

DRAWN		DATE
CHECKED		
APPROVED		
APPROVED		
CUSTOMER'S SPEC		
CONTRACT NO.		

Molectron

TITLE: POWER DISTRIBUTION CHASSIS WIRING DIAGRAM

LOCK (OR) NO	SIZE	DWG NO	REV
34285	E	060011	D

SCALE NONE

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

2. CONNECT A POWER SUPPLY TO TB7 ONLY IF / AFTER SUPPLY IS CONNECTED THRU J1, J2, OR J3 TO CAP. C1, C2 OR C3 AND TO BLEEDER R1 & RT, R2 & R8, OR R3 & R9.

4. TWIST TOGETHER: RED & BLACK; ORANGE & WHITE/BLACK/GREEN

	MY32/34	MY33/35
5 C1	31.3μF	77.2μF
6 L1	120μH	61μH
7 R7	6.81K	10.2K

8. WIRE J3 TO C1 (SAME AS FOR J1) FOR MY33-20 ONLY; WIRE J3 TO C2 (SAME AS FOR J2) FOR MY34-20 ONLY. OTHERWISE, J3 IS DELETED.

9. DO NOT CONNECT LUG TO CAPACITOR UNTIL PROPER TIME DURING TEST.

REFERENCE DESIGNATION		
FIRST	LAST	DELETED
A2	A12	A1, A4-A8
P1	P1	—
C1	C7	C3
J1	J7	—
L1	L2	—
R1	R11	R3, R6, R9
S1	S3	—
TB1	TB7	TB4
T1	T1	—

10. SHEET 1 IS OBSOLETE FOR NEW PRODUCTION.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED

GND — EC TB3-2

T1: EC TB1-6, EC TB1-7

+28 VDC RET: PDC TB9-5, EC TB1-4

+28 VDC: PDC TB9-6, EC TB1-3

I'LOCK: COM, NO

PS: +HV, HV RETURN

AMP PS: +HV, HV RETURN

OSC PS: +HV, HV RETURN

TB1, J3 RED(16), BLK (16), J2 RED (16), BLK (16), J1 RED(16), BLK(16)

F1, S2, S1

F2 2A 250V, S3

TB7: TO TB1-11, STP, BLK, RED; OSC. AMP SLAVE } P.S. TB3-4; PS ENABLE; E.C. TB4-1; OSC. P.S. TB3-3; AMP. P.S. TB3-5

R10 33K, 1W; R11 9.3K, ½W

A3, Q2A, Q1K, L2 61μH, C2 .772 μF 2KV, C5 .02μF 500V, 470μF 35V C7, TB6, A12

A2, Q2/A, Q1/K, L1, C1 2KV, T1, A9, A10, C4 .02μF 500V, 470μF 35V C6, TB5, A11, TB3, 2M 2W 2KV, 33K 2W, 10.2K 4W

TB2, BLK, RED, STP

J4 3RD SCR TRIG (E.C. A6-25,73); J5 OSC TRIG XFMR (T); J6 2ND SCR TRIG (E.C. A6-25,71); J7 AMP TRIG XFMR (T2)

LASER CHASSIS S4; OSC LAMPS K (J11) A (J8); AMP LAMPS K (J15) A (J12)

(HV RED); (WHT/BLK/GRN); (ORG); (RED)

It's not a normal switch, just an interlock. It's hidden behind the front panel (PFN).

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-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

	REF	QTY
CHECKED	MY3x	USED ON
	MY33	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON –
DEC .XX ± —— ANG ± ——
.XXX ± —— FIN —— √
BREAK ALL SHARP EDGES .005 - .020

MATERIAL: SEE P/L OF ASSY. DWG. 060023

FINISH

DRAWN BY: E Plant — DATE: 7/12/73
CHECKER
APPROVED: W. D. Fourte. — 10/1 —
APPROVED
CUSTOMER & SPEC
CONTRACT NO.
SIMILAR TO

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 735-2861

TITLE: PFN CHASSIS WIRING DIAGRAM

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060012	F

SCALE NONE — SHEET 3 OF 3

991375

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

2. CONNECT A POWER SUPPLY TO TB7 ONLY IF AFTER SUPPLY IS CONNECTED THRU J1, J2, OR J3 TO CAP. C1, C2 OR C3 AND TO BLEEDER RESISTORS R2 OR R8, OR R3 & R9.

3. TWIST TOGETHER: RED & BLACK; ORANGE & WHITE/RED; GREEN + GREEN. DO NOT BUNDLE THE GREEN WIRES TOGETHER WITH THE OTHER WIRES.

	MY32/34	MY33/35
5 C1	31.3μF	77.2μF
6 L1	120μH	61μH
7 R1	6.81K	10.2K

8. WIRE J3 TO C1 (SAME AS FOR J1) FOR MY-33-20 ONLY. WIRE J3 TO C2 (SAME AS FOR J2) FOR MY-34-20 ONLY. OTHERWISE, J3 IS DELETED.

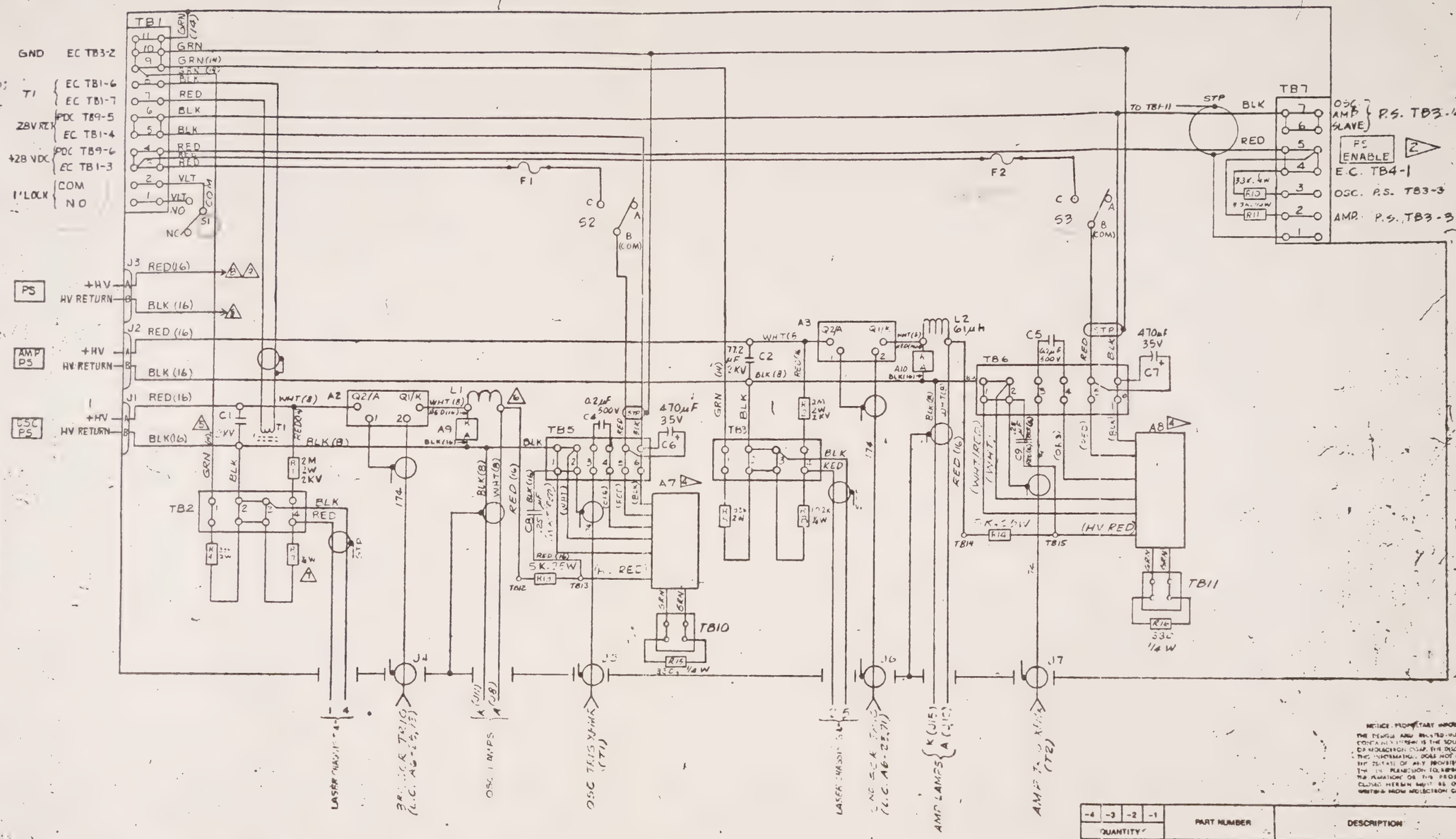
9. DO NOT CONNECT LUG TO CAPACITOR UNTIL PROPER TIME DURING TEST.

REFERENCE DESIGNATION		
FIRST	LAST	DELETED
A2	A10	A1,A4-A6
P1	P1	—
C1	C9	C3
J1	J7	—
L1	L2	—
R1	R16	R3,R6,R9,R12
S1	S2	—
TB1	TB15	TB4,TB5,TB9
T1	T1	—

10. SHEET 1 IS OBSOLETE FOR NEW PRODUCTION.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED



-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF. DESIG	ITEM

PARTS LIST

	FSN	QTY
		USED ON
		NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± — ANG ± —
.XXX ± — FIN —✓
BREAK ALL SHARP EDGES .005-.020

MATERIAL: SEE P/L OF ASSY. DWG. D60023

FINISH

DRAWN BY: L Hunt — DATE: 7/1/75
CHECKER
APPROVED: M. D. [illegible]
APPROVED
CUSTOMER & SPEC
CONTRACT NO.
SIMILAR TO

Molectron CORPORATION
977 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2961

TITLE: PEN CHASSIS WIRING DIAGRAM

CODE IDENT NO	SIZE	DWG NO.	REV
34285	D	D60012	F

SCALE: NONE — SHEET — OF

NOTICE: PROPRIETARY INFORMATION
THE DESIGN AND RELATED INFORMATION CONTAINED HEREIN IS THE SOLE PROPERTY OF MOLECTRON CORP. THE DISCLOSURE OF THIS INFORMATION DOES NOT CONSTITUTE THE CESSATE OF ANY PROPRIETARY RIGHT. THE UNPERMISSION TO REPRODUCE THE APPLICATION OR THE PRODUCTS SHOWN HEREIN MUST BE OBTAINED IN WRITING FROM MOLECTRON CORP.

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

2. CONNECT A FOH - SUPPLY TO TP2 ONLY IF AFTER SUPPLYS CHECKED THRU J1, J2, OR J3 TO CAN C1, C2 OR C3 AND TO BLEEDER RESET, REPLACE R2 & R9.

4. TWIST TOGETHER: RED & BLACK; ORANGE & WHITE/BLACK/GREEN

	MY32/34	MY32/35
5 C1	8.13μF	77.2μF
6 L1	120μH	61μH
7 R7	6.81K	10.2K

8. WIRE J3 TO C1 (SAME AS FOR J1) FOR MY33-20 ONLY. WIRE J3 TO C2 (SAME AS FOR J2) FOR MY34-20 ONLY. OTHERWISE, J3 IS DELETED.

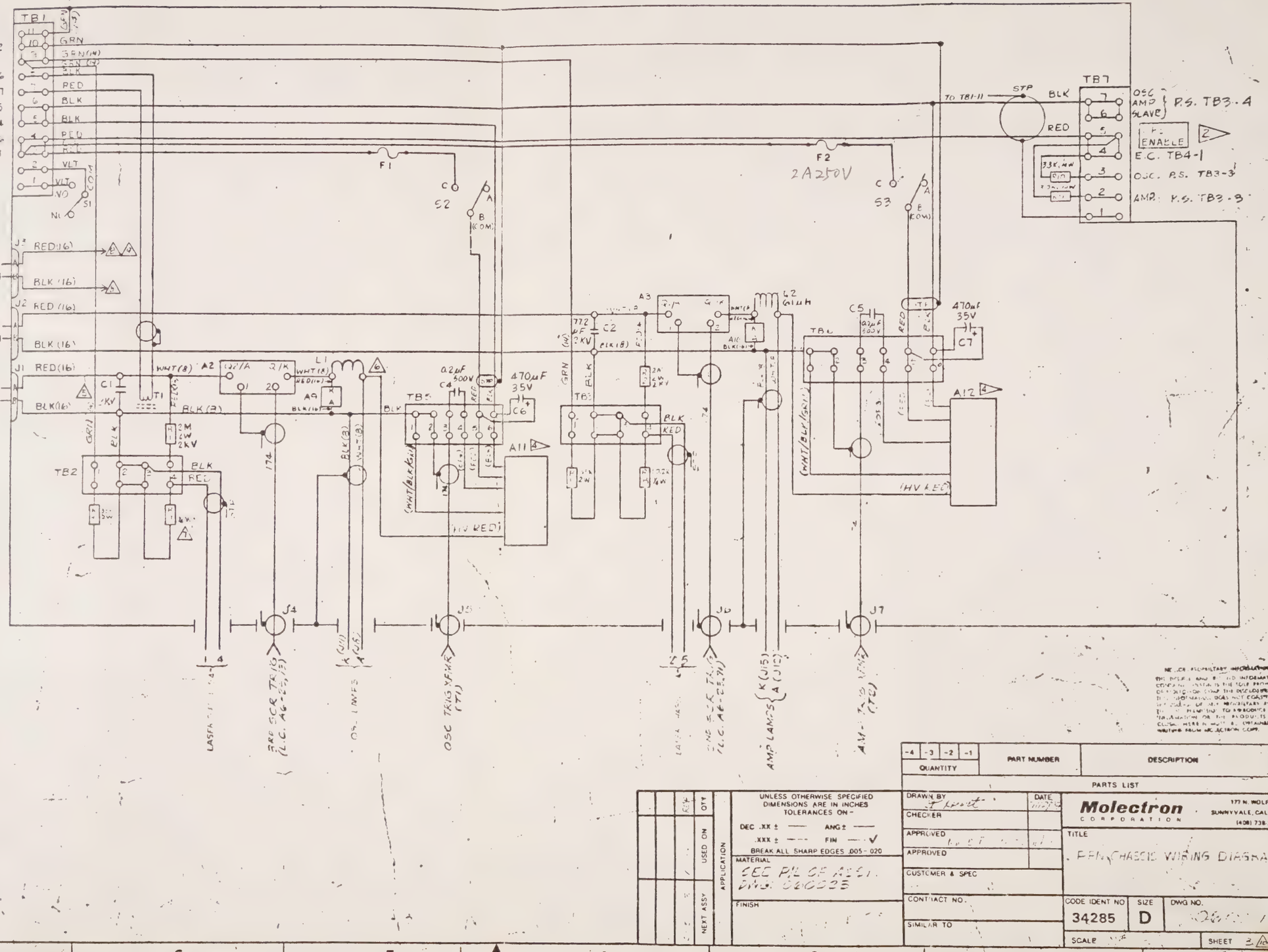
9. DO NOT CONNECT LUG TO CAPACITOR UNTIL PROPER TIME DURING TEST.

REFERENCE DESIGNATION		
FIRST	LAST	DELETED
A2	A12	A1,A4-A6
F1	F1	—
C1	C7	C3
J1	J7	—
L1	L2	—
R1	R11	R3,R5,R9,
S1	S2	—
TB1	TB7	TB4
T1	T1	—

10. SHEET 1 IS OBSOLETE FOR NEW PRODUCTION.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED



-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± —— ANG ± ——
.XXX ± —— FIN —— √
BREAK ALL SHARP EDGES .005 - .020
MATERIAL SEE PIL OF MISC. DWG. 060525
FINISH

USED ON / NEXT ASSY / APPLICATION / QTY

DRAWN BY [illegible] DATE [illegible]
CHECKER
APPROVED [illegible]
APPROVED
CUSTOMER & SPEC
CONTRACT NO.
SIMILAR TO

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2681

TITLE
P.P. CHASSIC WIRING DIAGRAM

CODE IDENT NO	SIZE	DWG NO.	REV
34285	D	[illegible]	F

SCALE —
SHEET 3 OF 3

PROPRIETARY INFORMATION
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NOTES:

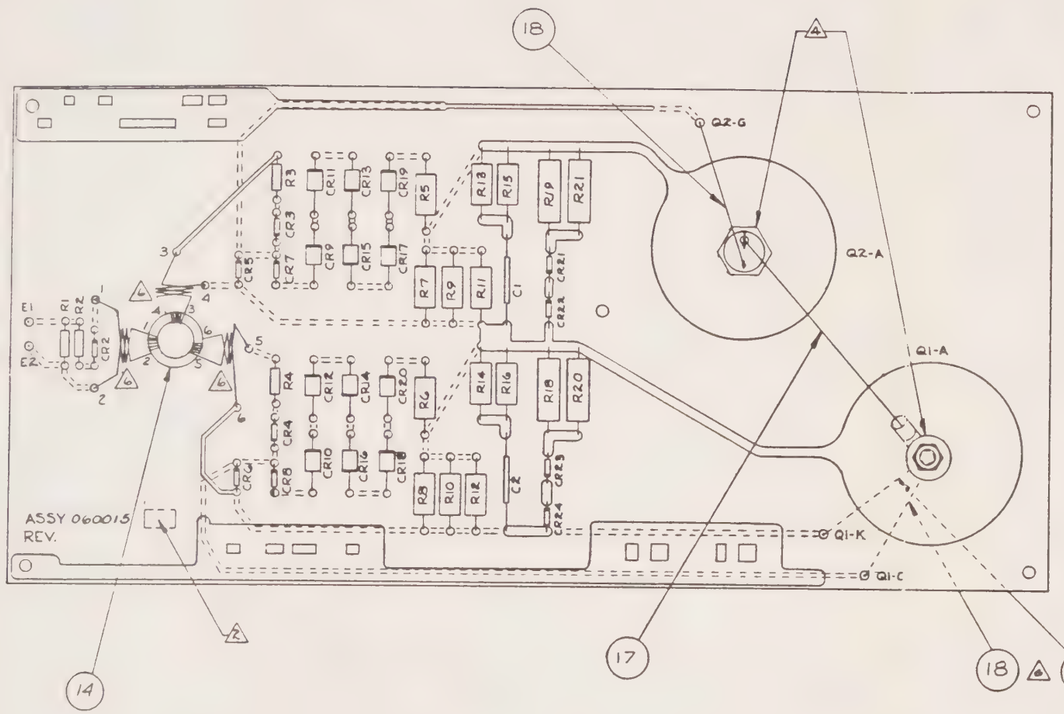
1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.
2. MARK APPLICABLE DASH NO. WHERE SHOWN.
3. TO CREATE -2 VERSION INSTALL Q1-A AS SHOWN IN END VIEW -2

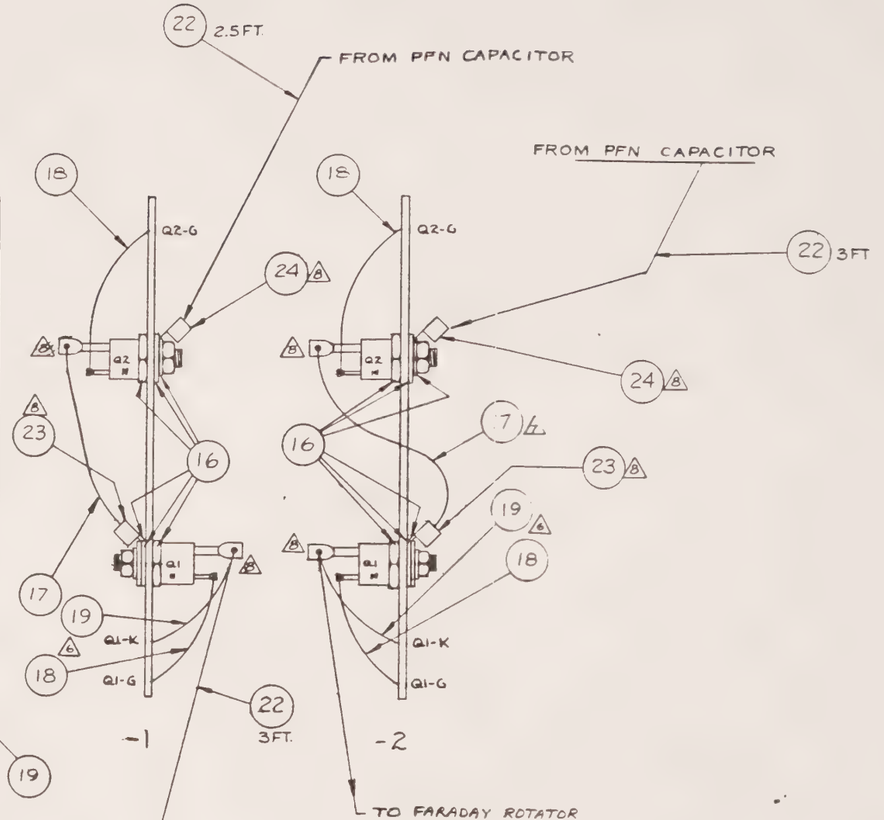
DO NOT MOUNT SCR'S TO BOARD UNTIL ASSY HAS BEEN THRU SONIC CLEANING

6. WIRES TO BE MINIMUM TWIST AND MINIMUM LENGTH.
7. WIRE TO BE ROUTED AROUND EDGE OF BOARD. (-2 ONLY)
8. THOROUGHLY REMOVE ALL FLUX & DEBRIS AFTER SOLDERING

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	PROD REL ECO#2004	4/12/79	WJ
B	PER ECO # 2016	5/4/79	AK
C	# 2042	9/11/79	WLF
D	ECO# 2791	9/28/81	WLF





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NOTE: SEE 'B' SIZE PARTS LIST

PARTS LIST

-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
2	1	2	1	MY35	MY33	MY34	MY32	USED ON
060023-4	060023-3	060023-2	060023-1					NEXT ASSY

QUANTITY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± — ANG ± —
.XXX ± — FIN — ✓
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH

DRAWN BY	Jon C	DATE 10-17-78
CHECKER		
APPROVED	Wm. D. Fourte...	2/4/80
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
PCB ASSEMBLY,
LAMP FLASHER SWITCH

CODE IDENT NO	SIZE	DWG NO	REV
34285	D	060015	D

SCALE 1:1 SHEET 1 OF 3

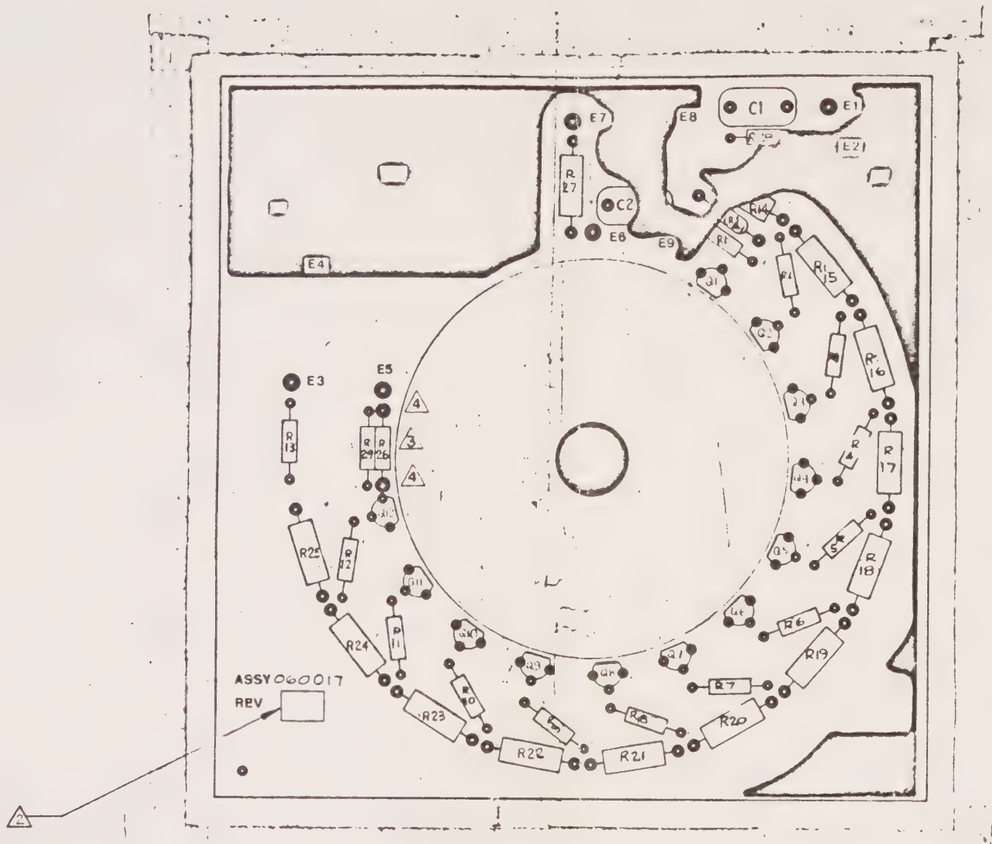
BISHOP GRAPHICS/ACCUPRESS
RED/ROER NO. A-8352

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.
2. MARK CURRENT REVISION LETTER IN BOX WITH BLACK EPOXY TYPE INK AT TIME OF ASSEMBLY.
3. WHEN LASER HAS MY-SAM OPTION &/OR MY-SF OPTION, R26 IS REMOVED FROM THIS ASSY.
4. UNMARKED 'E'-TYPE TERMINAL; ALIGN THIS COMPONENT SLOT OF THE TWO TERMINALS TO THE AXIAL LEADS OF R26

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	REL. ECO # 2004	9/12/79	WNF
B	ECO # 2106	11-8-79	WDF
C	ECO # 2656	5/28/81	WNF
D	ECO # 2668	5/28/81	WNF



SEE SEPARATE "B" SIZE P/L.

-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

				QTY	
				USED ON	
				NEXT ASSY	
				APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± — ANG ± —
.XXX ± — FIN —
BREAK ALL SHARP EDGES .005 - 020
MATERIAL
FINISH

DRAWN BY G.S DATE 10/30/79
CHECKER
APPROVED
APPROVED
CUSTOMER & SPEC
CONTRACT NO.
SIMILAR TO

Molectron CORPORATION
177 N WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2641

TITLE -
POCKELS CELL DRIVER BOARD ASSEMBLY

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060017	D

SCALE 2 : 1 SHEET 1 OF 2

SOURCE - PROPRIETARY INFORMATION -
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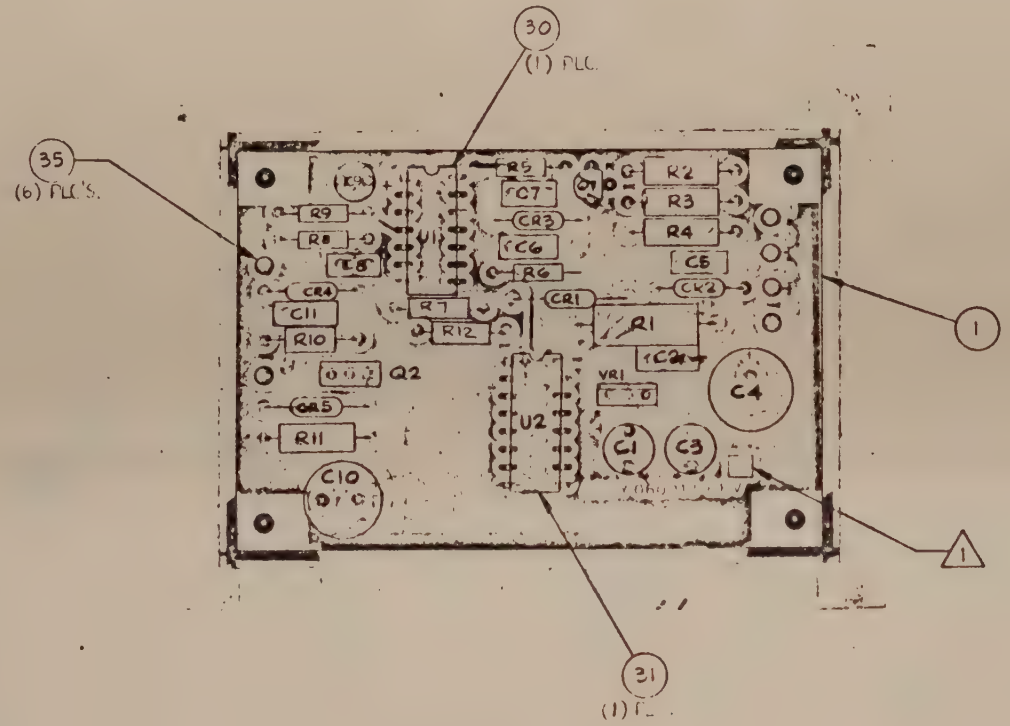
NOTES:

1. MARK CURRENT REVISION LETTER IN BOX WITH BLACK EPOXY TYPE INK AT TIME OF ASSEMBLY

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	RELEASE PER ECO 2022	4/12/79	[illegible]
B	ECO # 2114	[illegible]	[illegible]
C	ECO # 2181	[illegible]	[illegible]



SEE SEPARATE "B" SIZE P/L

-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
				PARTS LIST				

QTY	1				
USED ON	[illegible]				
NEXT ASSY	060018				
APPLICATION					

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
XXX ± FIN ✓
BREAK ALL SHARP EDGES .005 .020

MATERIAL

FINISH

DRAWN BY	G.S.	DATE 5/8
CHECKER		
APPROVED		
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron
177 N WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738 2661

TITLE
ASSEMBLY
EVENTS COUNTER
PULSED YAG

CODE IDENT NO	SIZE	DWG NO	REV
34285	C	060018	C

SCALE 2 1 SHEET 1 OF 3

991597

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NOTES:

1. ALL CONDUCTORS TO OR FROM THE POWER DISTRIBUTION CHASSIS THE PRN CHASSIS OR THE CHARGING POWER SUPPLIES ARE ROUTED THRU THE UMBILICAL
2. UNUSED TERMINALS NOT SHOWN
3. J1 P1 ARE THE BRS DEFEATABLE INTERLOCK FOR THE HARMONICS BOX LID.
4. ANY ONE OR TWO OF P23-P24 CAN BE CONNECTED TO J22 AND/OR J23.
5. SELECT INDIVIDUALLY DURING SYSTEM TEST
6. MAKE CONNECTIONS TO CENTER CONDUCTORS AS SHORT AS POSSIBLE. OR BOARD END MAKE GROUND LEAD AS SHORT AS POSSIBLE
7. -2 VERSION (50-H2 VERSION) ONLY.

REVISIONS			
LTR	DESCRIPTION / ECO	DATE	APPROVED
A	PROD REL. ECO #1123	10/23/79	WLF
B	ECO # E195	4-5-80	WLF
C	ECO # 2230	3/7/80	WLF
D	ECO # 2423	9/16/80	"
E	ECO # 2552	6/23/81	WLF
F	ECO # 2658	5/5/82	WLF
G	ECO # 2962	5/27/82	WLF

FROM	TO	COLOR
A1	A2	A0, A8, A7
A1	A3	
A2	A3	
P23	J23	
P24	J24	
J1	J23	J7, J14, J19
J1	J24	
A1	A1	
P2	P21	P2 - P17
P3	P22	
P4	P23	
P5	P24	
T1	T2	
TB1	TB2	
TB3	TB4	

QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
		PARTS LIST		

DRAWN B. Blank 10/27/80
CHECKED
APPROVED
APPROVED
CUSTOMER & SPEC
CONTRACT NO
FAMILY TO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DEC .XX ± —— ANG ± —— .XXX ± —— FRA ± —— V
MATERIAL SEE P/L 060037 W/L 060420 ; AND W/L 060427
FINISH

Molectron
SUNNYVALE, CA

TITLE
LASER CHASSIS WIRING DIAGRAM

CODE IDENT NO	SIZE	DWG NO	REV
34285	E	060019	G

SCALE NONE SHEET 1 OF 1

NOTES:

1. ALL CONDUCTORS TO OR FROM THE POWER DISTRIBUTION CHASSIS, THE PFN CHASSIS, OR THE CHARGING POWER SUPPLIES ARE ROUTED THRU THE UMBILICAL.
2. UNUSED TERMINALS NOT SHOWN.
3. J1, P1 ARE THE 6PIN DEFEATABLE INTERLOCK FOR THE HARMONICS BOX LID.
4. ANY ONE OR TWO OF P22-P24 CAN BE CONNECTED TO J22 AND/OR J23.

5. SELECT INDIVIDUALLY DURING SYSTEM TEST.
6. MAKE CONNECTIONS TO CENTER CONDUCTORS AS SHORT AS POSSIBLE. ON BOARD END, MAKE GROUND LEAD AS SHORT AS POSSIBLE.
7. -8 VERSION (EC-118 VERSION) ONLY.

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	INITIAL REL. ECO#2185	10/24/79	ST
B	ECO # 2195	1/5/80	BJT
C	ECO # 2230	3/5/80	MCF
D	ECO # 2423	9/16/81	WHF
E	ECO # 2552	4/6/81	WHF
F	ECO # 2658	5/1/81	WHF
G	ECO # 2962	5/21/82	MCF

REFERENCE DESIGNATIONS		
PRINT	UNIT	DELETED
A1	A1	A6, A8, A9
C81	C1	—
C82	C2	—
F1	F1	—
J1	J1	J7, J16, J17
L1	L1	—
R1	R1	—
P1	P1	P2 - P17
T1	T1	—
XDS1	XDS1	—
XDS2	XDS2	—

QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
PARTS LIST				

DRAWN BY: D. Hunt 8/3/79
CHECKED
APPROVED
APPROVED
CUSTOMER'S SPEC.
CONTRACT NO.
SIMILAR TO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON: DEC XX ± —, ANG ± —, XXX ± —, FRC —. BREAK ALL SHARP EDGES .005 - .015

MATERIAL: SEE P/L 060037 W/L 060420, AND W/L 060427

FINISH

Molectron — 177 E. MOFFETT ROAD, SUNNYVALE, CALIFORNIA 94086

TITLE: LASER CHASSIS WIRING DIAGRAM

CODE IDENT NO. 34285 | SIZE E | DWG NO. 060017 | REV G

SCALE NONE | SHEET 1 OF 1

NOTES:
1. WIRING DIAGRAM IS 060011

LTR	DESCRIPTION/ECO	DATE	APPROVED
A	[illegible]	4/27/74	[illegible]
B	ECO # 2122	5/23/74	[illegible]
C	ECO # 2097	[illegible]	[illegible]
D	ECO # 2157	[illegible]	[illegible]
E	ECO NO. 2253	[illegible]	[illegible]
F	ECO NO. 2297	[illegible]	[illegible]
G	ECO # 2667	[illegible]	[illegible]
H	ECO # 2919	[illegible]	[illegible]
J	ECO [illegible]	[illegible]	[illegible]

(51) (52) (65) 2 REQD (64) 4 REQD (66) (53) (56) F1 F2 F3 F4 F5 F6 B1 NO NC DS1 LINE LOAD CB1 DS2 DS3 DS4 (33) (35) (36) 3 REQD (32) (35) (36) (34) (55) 3 REQD (38) (63) 4 REQD (39) (19) (18) (20) 2 REQD (43) (60) 3 REQD (50)

(145) (149) (166) 2 REQD (167) 3 REQD (59) (2) (63) (11) (12) (28) (62) 2 REQD

K7 K8 K2 TB1 TB4 TB5 TB3 TB2 TB6 TB7 A3

(27) (8) (61) 2 REQD (10) (30) (70) (71) 4 REQD (72) 8 REQD

(57) (58) (9) 2 REQD (3) 3 REQD (17) (24) (41) 4 REQD 8 REQD (8) (15) (69) 2 REQD

VIEW A-A

K1 K3 K6 K5 A2

(40) (46) (57) (60) (44) (45) (48) (49) (47) (68) (42) (65) (69) (71) 2 REQD (7) (31) (60) 4 REQD 8 REQD

060035	YAG	
NEXT ASSY	USED ON	QTY

APPLICATION

DRAWN BY: JON C — DATE: 9 JAN 74
CHECKED:
APPROVED: Alan D. Fowler — DATE: [illegible]
APPROVED:
CUSTOMER & SPEC:
CONTRACT NO:
SIMILAR TO:

Malectron

TITLE: POWER DISTRIBUTION ASSY

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	E	060021	J

SCALE 1:1 — SHEET 1 OF 6

WIRING DIAGRAM IS OF

1 MY 33/35 ONLY

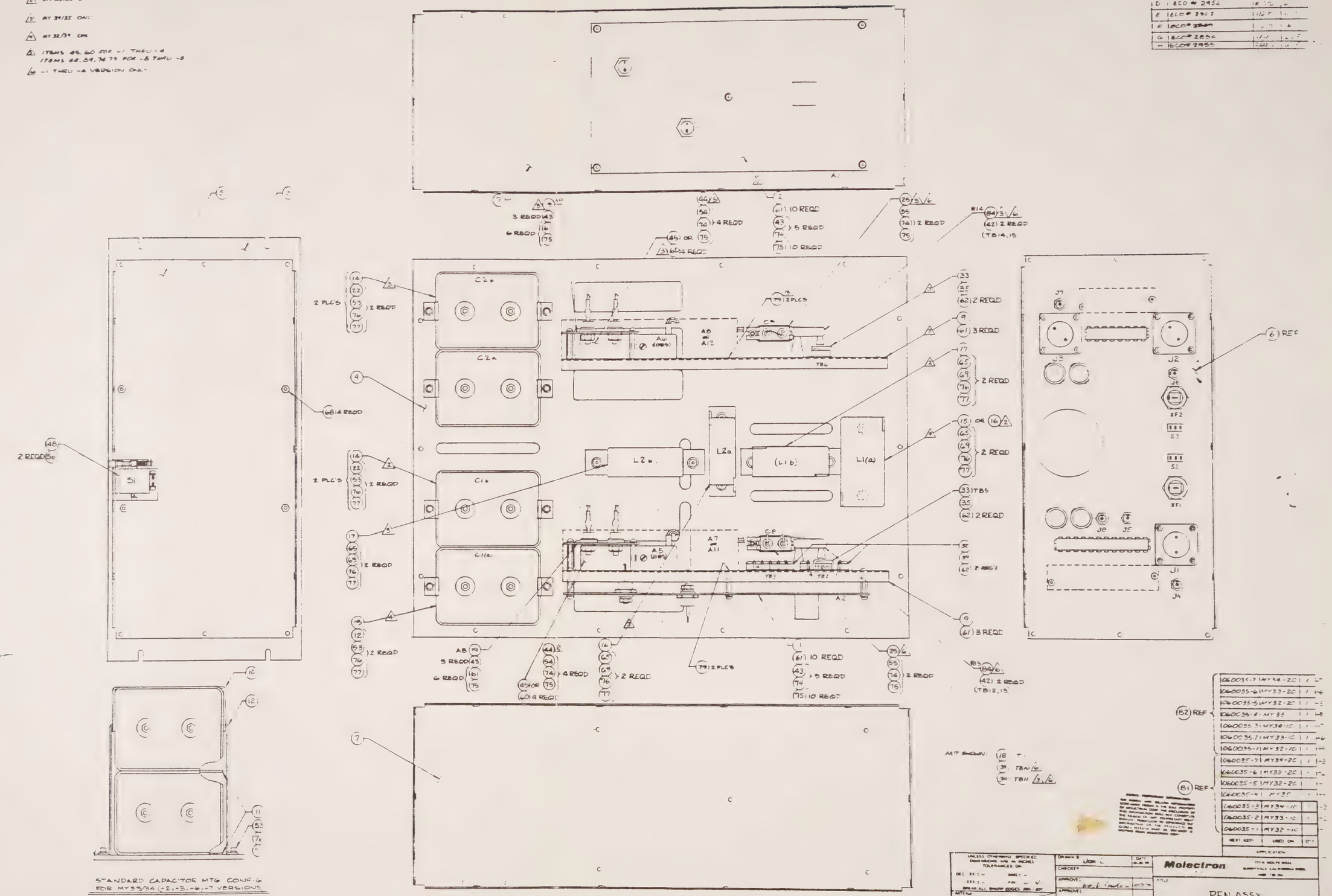
2 MY 34/35 ONLY

3 MY 32/34 ONLY

4 ITEMS 46,60 FOR -1 THRU -4
ITEMS 44,54,74,79 FOR -5 THRU -6

5 -1 THRU -4 VERSION ONLY

REVISION			
LTR	DESCRIPTION (ECC)	DATE	APPROVED
A	PROD REL ECO # 980 10 PLCS ONLY	4/13/79	WDF
B	ECO # 2122	10/23/79	
C	ECO # 2243	3/19/80	
D	ECO # 2456	8/	
E	ECO # 2503	11/2	
F	ECO # 2547		
G	ECO # 2854	12/	
H	ECO # 2955	7/82	



STANDARD CAPACITOR MTG CONF:6
FOR MY33/34 (-2,-3,-6,-7 VERSIONS

1060035-7	MY34-2C	1	
1060035-6	MY33-2C	1	
1060035-5	MY32-2C	1	
1060035-4	MY35	1	
1060035-3	MY34-1C	1	
1060035-2	MY33-1C	1	
1060035-1	MY32-1C	1	
REF'I ASSY	USED ON	QTY	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DEC ± .X = ANG ± .XXX = FRAC ± BREAK ALL SHARP EDGES .005 - .015

DRAWN B JON C DATE 10-8-79
CHECKED
APPROVED
APPROVED
CUSTOMER & SPEC.
CONTRACT NO.
SIMILAR TO

Molectron

TITLE: P.C. ASSY

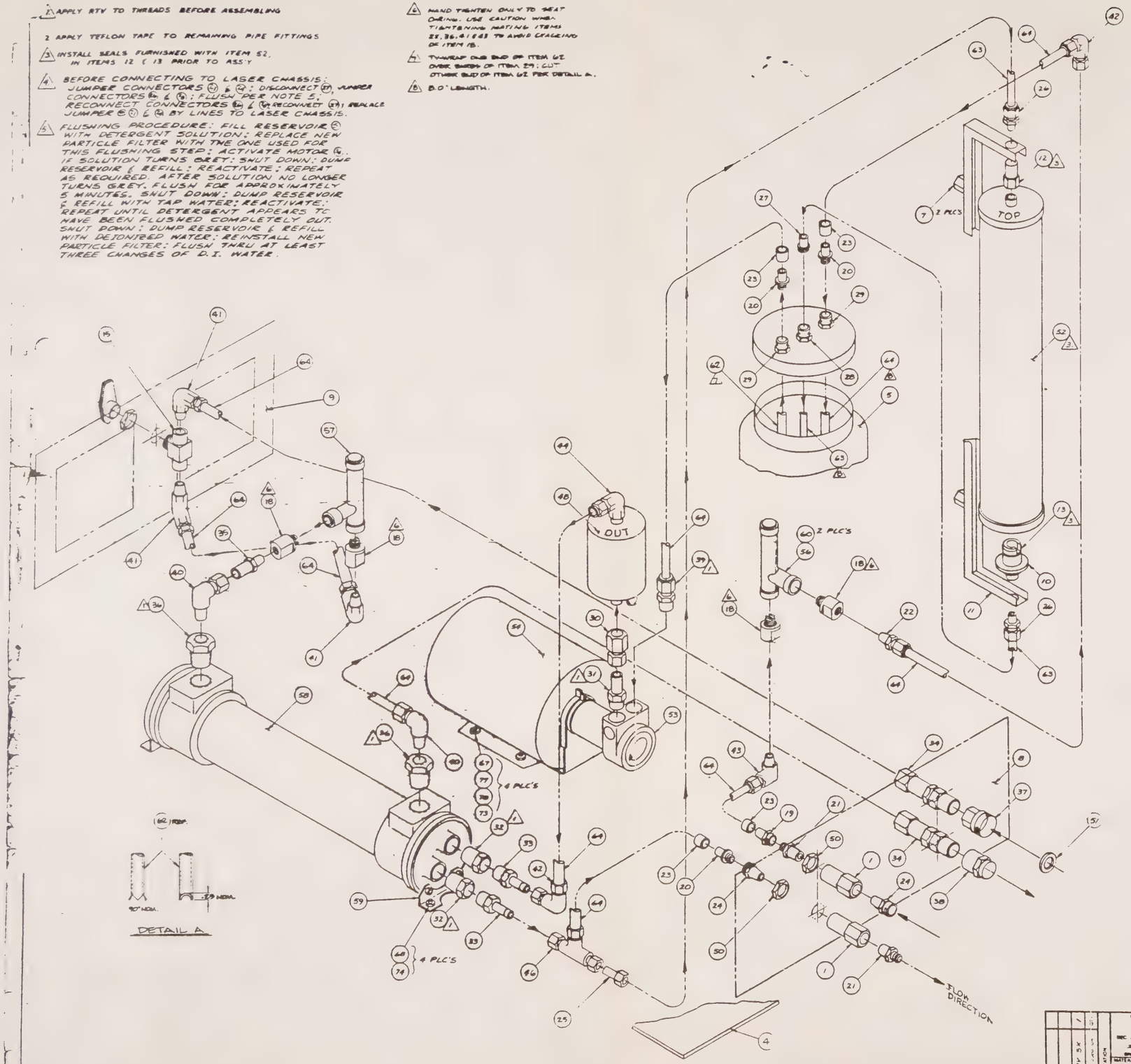
CODE IDENT NO. 34285 | SIZE E | DWG NO. J60023 | REV. H

SCALE NONE | SHEET OF

NOTES:

1. APPLY RTV TO THREADS BEFORE ASSEMBLING
2. APPLY TEFLON TAPE TO REMAINING PIPE FITTINGS
3. INSTALL SEALS FURNISHED WITH ITEM 52, IN ITEMS 12 & 13 PRIOR TO ASS'Y
4. BEFORE CONNECTING TO LASER CHASSIS: JUMPER CONNECTORS (57) & (58): DISCONNECT (59), JUMPER CONNECTORS (60) & (61): FLUSH PER NOTE 5. RECONNECT CONNECTORS (60) & (61) RECONNECT (59); REPLACE JUMPER (57) & (58) BY LINES TO LASER CHASSIS.
5. FLUSHING PROCEDURE: FILL RESERVOIR (2) WITH DETERGENT SOLUTION; REPLACE NEW PARTICLE FILTER WITH THE ONE USED FOR THIS FLUSHING STEP; ACTIVATE MOTOR (6). IF SOLUTION TURNS GREY: SHUT DOWN; DUMP RESERVOIR & REFILL; REACTIVATE; REPEAT AS REQUIRED. AFTER SOLUTION NO LONGER TURNS GREY, FLUSH FOR APPROXIMATELY 5 MINUTES. SHUT DOWN; DUMP RESERVOIR & REFILL WITH TAP WATER; REACTIVATE; REPEAT UNTIL DETERGENT APPEARS TO HAVE BEEN FLUSHED COMPLETELY OUT. SHUT DOWN; DUMP RESERVOIR & REFILL WITH DEIONIZED WATER; REINSTALL NEW PARTICLE FILTER; FLUSH THRU AT LEAST THREE CHANGES OF D.I. WATER.
6. HAND TIGHTEN ONLY TO SEAT O-RING. USE CAUTION WHEN TIGHTENING MATING ITEMS 22, 36, 41 & 63 TO AVOID CRACKING OF ITEM 18.
7. TYWRAP OVER END OF ITEM 62 OVER SHEATH OF ITEM 29; CUT OTHER END OF ITEM 62 PER DETAIL A.
8. 8.0" LENGTH.

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	PROD. REL. ECO #1986 (P/L ONLY)	11/30/79	G. WOLF
B	ECO # 2042	9/16/80	"
C	ECO # 2398	8/16/82	"
D	ECO # 2493	11/1/83	"
E	ECO # 2625	4/24/84	"
F	ECO # 2769	5/1/85	"
G	ECO # 2816	6/3/85	"
H	ECO # 3099	12/1/87	"



SEE SEPARATE P/L-060026

QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
-4 -3 -2 -1		PARTS LIST		

DRAWN BY	G.L.C 79
CHECKED	
APPROVED	
APPROVED	
CUSTOMER & SPEC	
CONTRACT NO	
SIMILAR TO	

Molectron — 177 N. WOLFE ROAD, SUNNYVALE, CALIFORNIA 94086

TITLE: COOLER ASS'Y

CODE IDENT NO.	SIZE	DWG. NO.	REV
34285	E	060026	H

SCALE: NONE — SHEET 1 OF 5

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DEC .XX ± —, ANG ± —, .XXX ± —, FIN —. BREAK ALL SHARP EDGES .005 - .020. MATERIAL. FINISH.

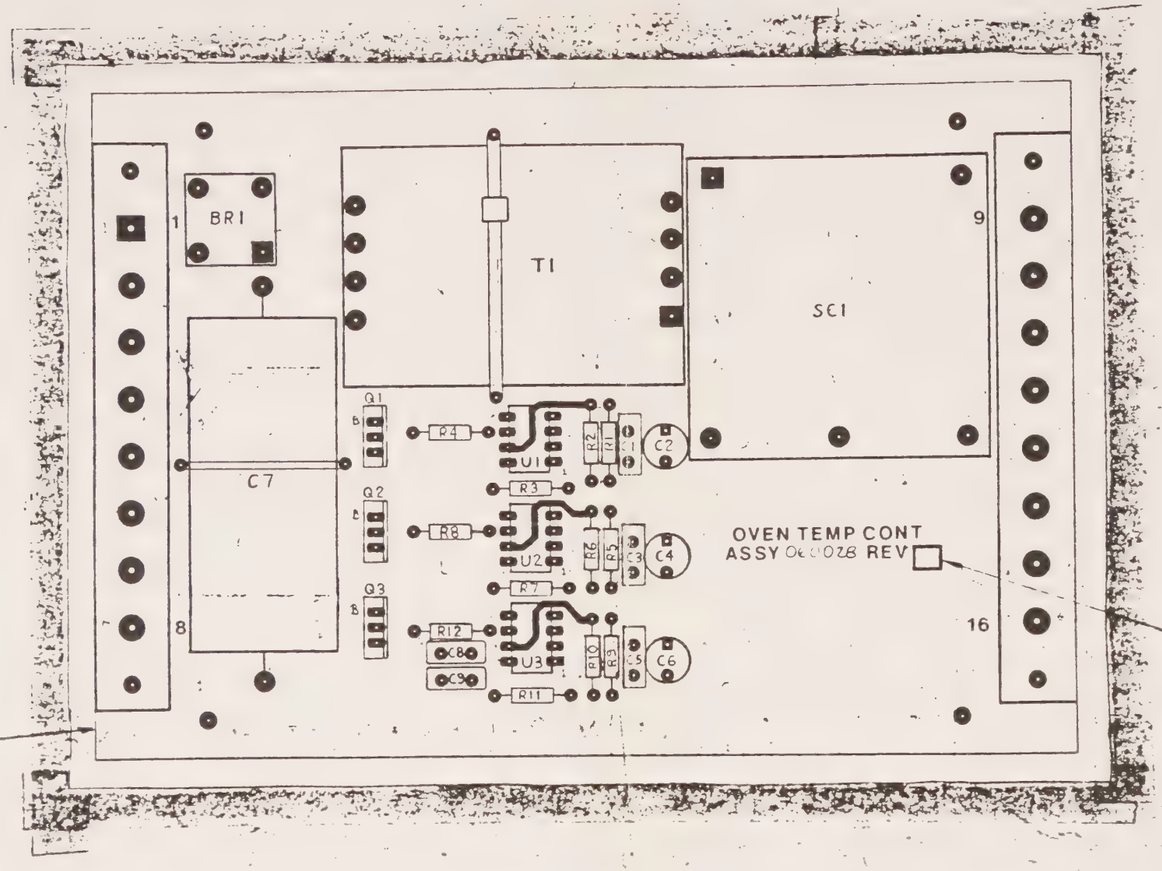
APPLICATION: 060035 Rev 5X

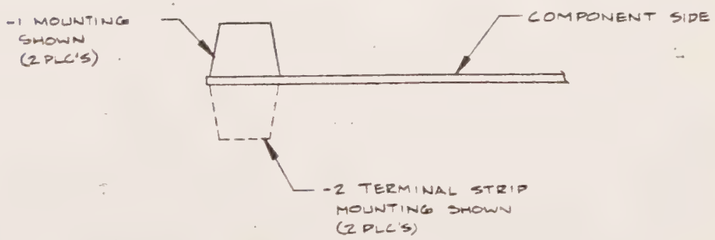
NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.
2. GROUND PLANE NOT SHOWN

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	RELEASE ECO# 2004	4/12/79	[illegible]
B	ECO# 2147	11-26-79	[illegible]
C	ECO # 2228	3-3-80	[illegible]
D	ECO# 2839	11/29/81	[illegible]
E	ECO# 2962	3/21/82	[illegible]





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SEE SEPARATE 'B' SIZE PARTS LIST

-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

—	—	—	—	QTY
DL284	MY3X	MY3X	M/E2X	USED ON
071460	C60XXX	060573	060021	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± —— ANG ± ——
.XXX ± —— FIN —— √
BREAK ALL SHARP EDGES .005-.020

MATERIAL: SEE 'B' SIZE PARTS LIST

FINISH:

DRAWN BY	G.S.	DATE 9/7/79
CHECKER	[signature]	9/13/79
APPROVED	[signature]	[illegible]
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2681

TITLE
P.C. ASSEMBLY
OVEN CONTROLLER,

CODE IDENT NO	SIZE	DWG NO.	REV
34285	D	060028	E

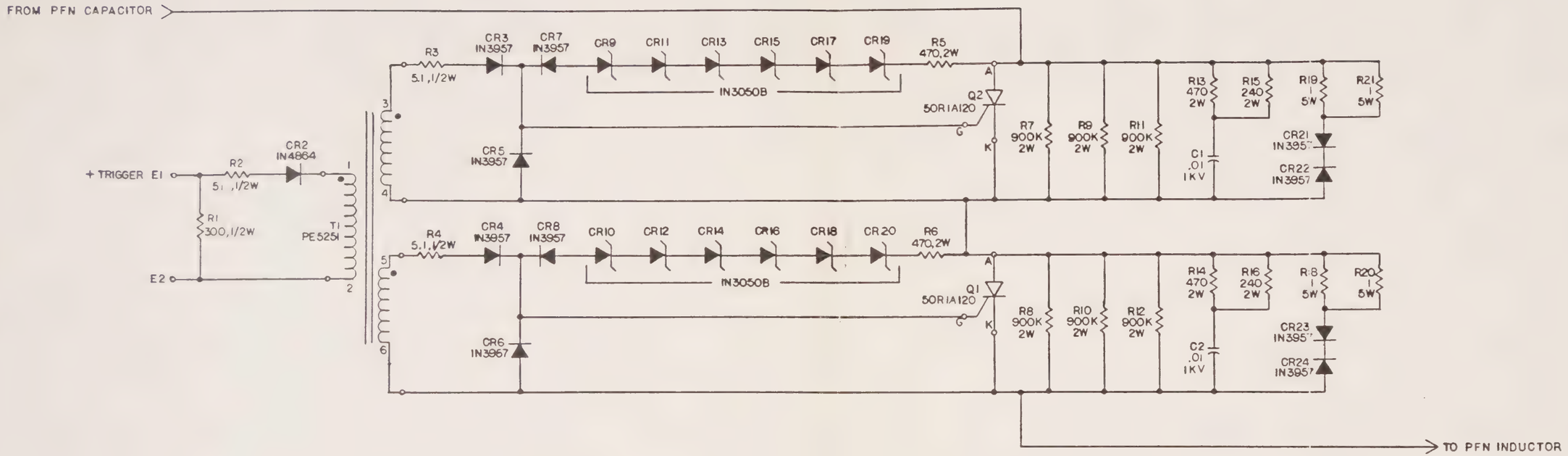
SCALE 2 X 1 SHEET 1 OF 2

NOTES

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.
2. UNLESS OTHERWISE INDICATED:
   CAPACITOR VALUES ARE IN MICROFARADS,
   DIODES ARE ——,
   INDUCTOR VALUES ARE IN ——,
   RESISTOR VALUES ARE IN OHMS, — W, 5 %,
   TRANSISTORS ARE SCR.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DELETED CR1 & E3	6-30-78	WDF
B	Q1 NOW Q2, R21 ADDED, ECO #2004	9-11-78	WDF
C	R1 WAS 100 Ω, R2 WAS 75 Ω, R3+R4 WERE 22 Ω	2-8-79	WDF
D	REL. ECO #2004	4/11/79	WDF
E	ECO #2488	11/13/80	WDF



REFERENCE DESIGNATORS		
FIRST	LAST	DELETED
C1	C2	——
CR2	CR24	CR1
E1	E2	——
Q1	Q2	——
R1	R21	——
T1	T1	——

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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

			QTY
		YAG	USED ON
			NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± —— ANG ± ——
.XXX ± —— FIN ✓
BREAK ALL SHARP EDGES .005-.020

MATERIAL ——

FINISH ——

DRAWN BY	M KING	DATE 9-20-77
CHECKER	WDF	9/23/77
APPROVED		
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE CALIFORNIA 94086
(408) 738-2561

TITLE
SCHEMATIC, DUAL LAMP FLASHER SWITCH

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060061	E

SCALE —— SHEET / OF /

B-SHOP GRAPHICS/ACCUPRESS REORDER NO. A-8352

NOTES: UNLESS SPECIFIED OTHERWISE

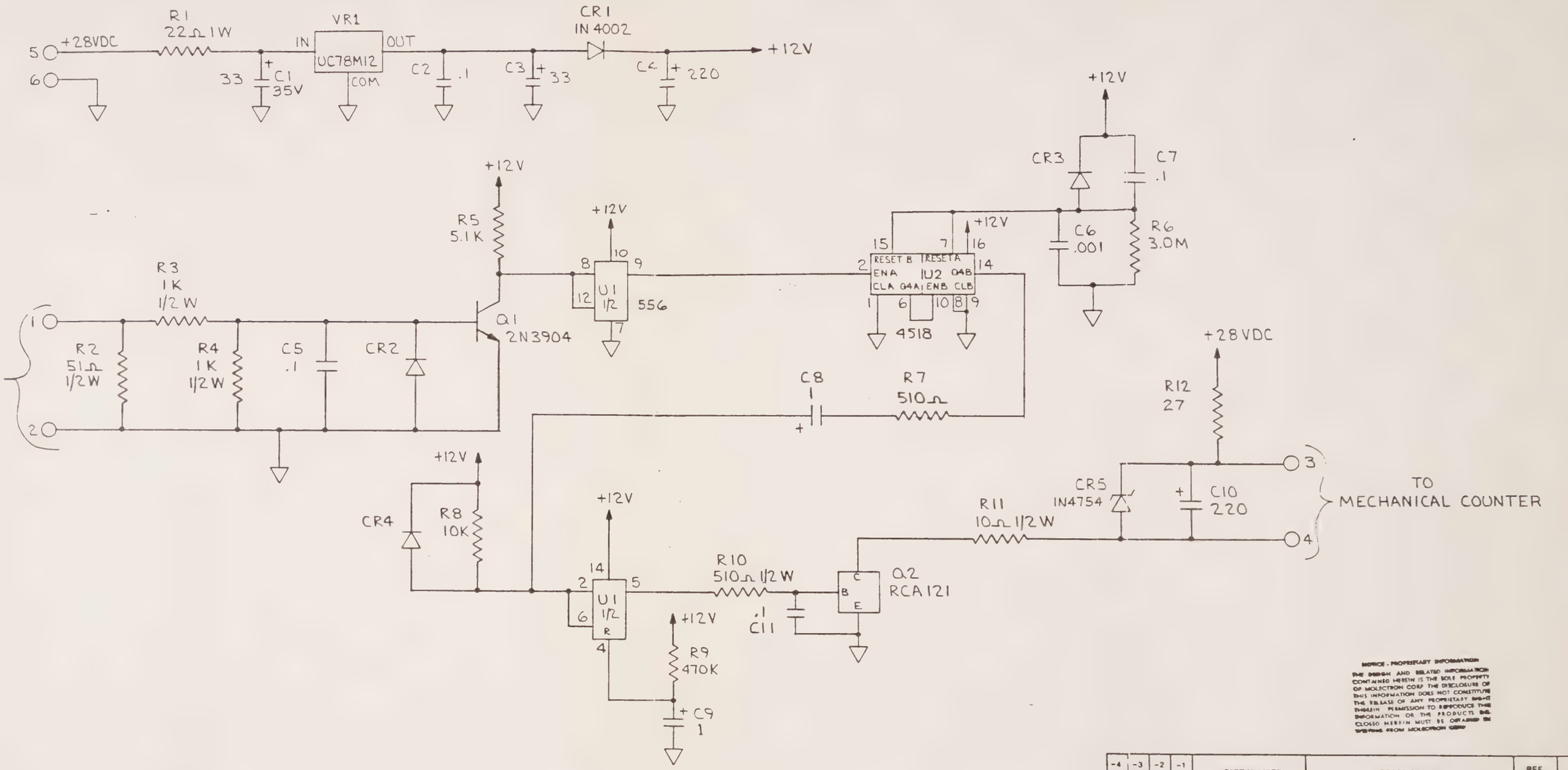
⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

2. ALL DIODES ARE IN4150

3. LAST REFERENCE DESIGNATIONS USED: U3, R12, C10, CR5, C11, VR1

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	RELEASE PER ECO 2004	4/12/79	JHC
B	ECO #2114	10/[illegible]/79	[illegible]



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-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

REF	QTY
YAG	USED ON
—	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH

DRAWN BY M. WAYRYNEN — DATE 6-26-78
CHECKED
APPROVED — 7-16-79
APPROVED
CUSTOMER & SPEC
CONTRACT NO.
SIMILAR TO

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE CALIFORNIA 94086
(408) 738-2661

TITLE
SCHEMATIC
EVENTS COUNTER

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060067	B

SCALE — SHEET 1 OF 1

991594

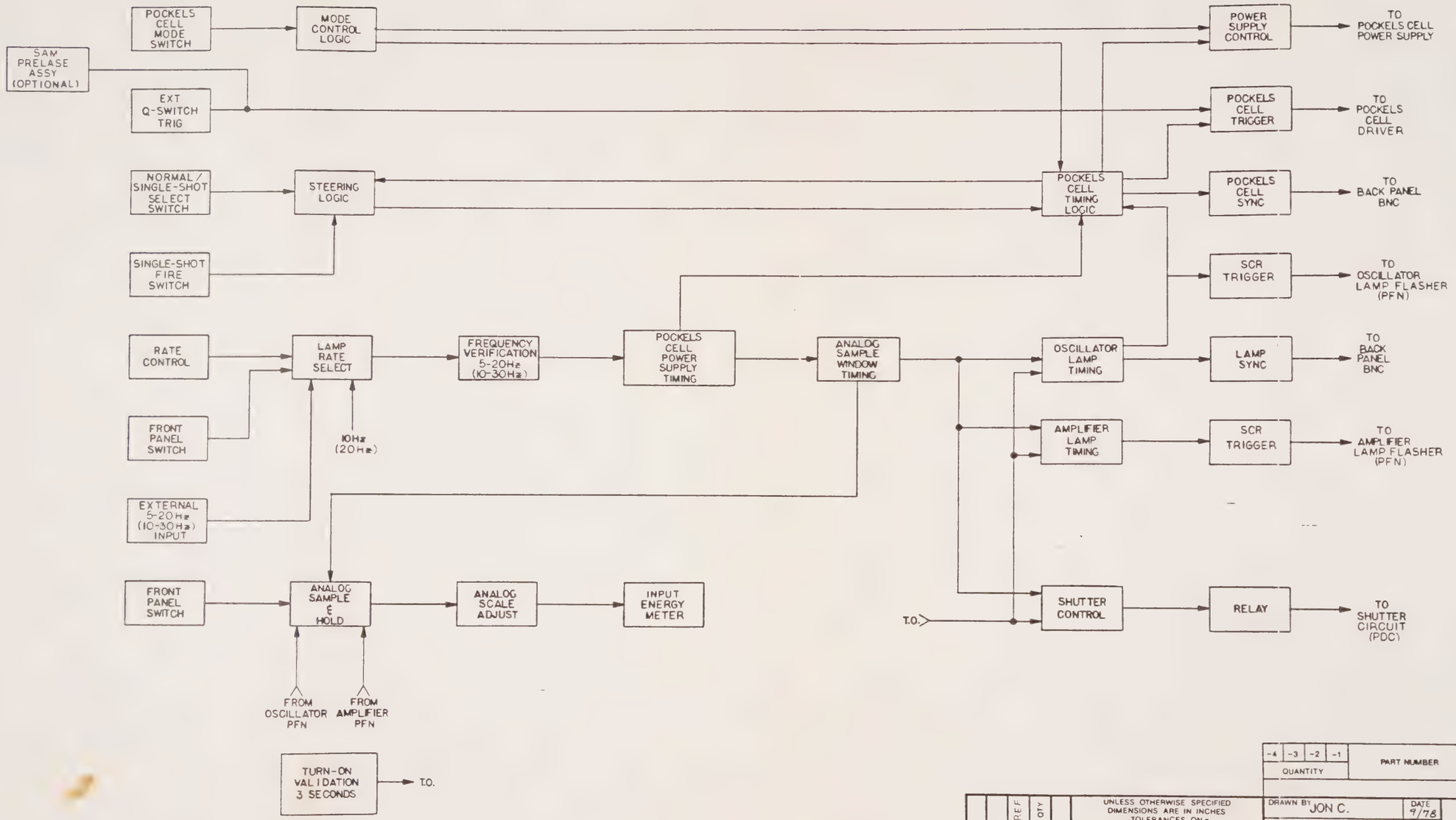
© BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-6362

NOTES

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	1-9-78	9/PC
B	RELEASE ECO# 2004	4-18-79	CJC
C	ECO # 2513	12/4/80	WDF
D	ECO# 2984	5/22/82	WDF



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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

REF	QTY	APPLICATION	USED ON
MY 3 x			NEXT ASSY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH

DRAWN BY JON C. DATE 9/78
CHECKER
APPROVED 11/79
APPROVED
CUSTOMER & SPEC
CONTRACT NO.
SIMILAR TO

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2561

TITLE
MAIN CONTROL CARD
BLOCK DIAGRAM

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060123	D

SCALE —— SHEET 1 OF 1

© BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-8352

NOTES:

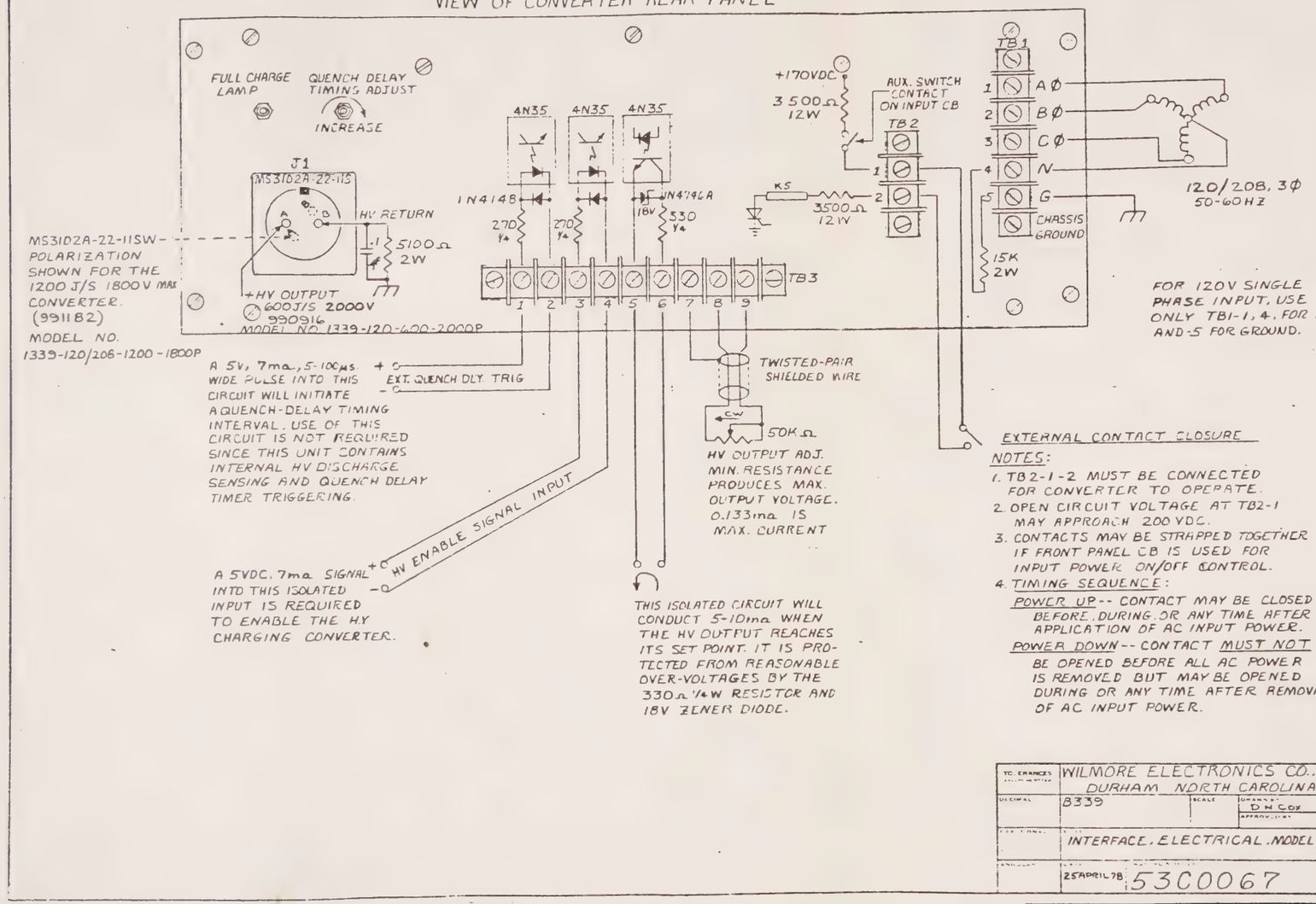
⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	1/29/79	W.C.F
B	RELEASE ECO#2004	1/30/79	W.F

CIRCUIT BREAKER ON FRONT PANEL
3φ INPUT 20A TRIP AT 25A 3POLE
1φ INPUT 25A TRIP AT 31A 2POLE

VIEW OF CONVERTER REAR PANEL


FULL CHARGE LAMP
QUENCH DELAY TIMING ADJUST
INCREASE
J1
MS3102A-22-11S
HV RETURN
5100Ω 2W
+HV OUTPUT 600J/S 2000V
990916
MODEL NO. 1339-120-600-2000P
4N35
4N35
4N35
1N4148
270 ¼
270 ¼
1N4746A
18V
330 ¼
TB3
+170VDC
3500Ω 12W
AUX. SWITCH CONTACT ON INPUT CB
TB2
K5
3500Ω 12W
TB1
A Ø
B Ø
C Ø
N
G
CHASSIS GROUND
15K 2W
120/208, 3Φ 50-60HZ
MS3102A-22-11SW-
POLARIZATION SHOWN FOR THE 1200 J/S 1800V MAX CONVERTER. (991182)
MODEL NO. 1339-120/208-1200-1800P
FOR 120V SINGLE PHASE INPUT, USE ONLY TB1-1, 4. FOR AC AND-5 FOR GROUND.
A 5V, 7ma, 5-100μs WIDE PULSE INTO THIS CIRCUIT WILL INITIATE A QUENCH-DELAY TIMING INTERVAL. USE OF THIS CIRCUIT IS NOT REQUIRED SINCE THIS UNIT CONTAINS INTERNAL HV DISCHARGE SENSING AND QUENCH DELAY TIMER TRIGGERING.
EXT. QUENCH DLY. TRIG
HV ENABLE SIGNAL INPUT
A 5VDC. 7ma. SIGNAL INTO THIS ISOLATED INPUT IS REQUIRED TO ENABLE THE H.V. CHARGING CONVERTER.
TWISTED-PAIR SHIELDED WIRE
CW
50KΩ
HV OUTPUT ADJ. MIN. RESISTANCE PRODUCES MAX. OUTPUT VOLTAGE. 0.133ma. IS MAX. CURRENT
THIS ISOLATED CIRCUIT WILL CONDUCT 5-10ma WHEN THE HV OUTPUT REACHES ITS SET POINT. IT IS PROTECTED FROM REASONABLE OVER-VOLTAGES BY THE 330Ω ¼W RESISTOR AND 18V ZENER DIODE.

EXTERNAL CONTACT CLOSURE

NOTES:
1. TB2-1-2 MUST BE CONNECTED FOR CONVERTER TO OPERATE.
2. OPEN CIRCUIT VOLTAGE AT TB2-1 MAY APPROACH 200 VDC.
3. CONTACTS MAY BE STRAPPED TOGETHER IF FRONT PANEL CB IS USED FOR INPUT POWER ON/OFF CONTROL.
4. TIMING SEQUENCE:
   - POWER UP -- CONTACT MAY BE CLOSED BEFORE, DURING, OR ANY TIME AFTER APPLICATION OF AC INPUT POWER.
   - POWER DOWN -- CONTACT MUST NOT BE OPENED BEFORE ALL AC POWER IS REMOVED BUT MAY BE OPENED DURING OR ANY TIME AFTER REMOVAL OF AC INPUT POWER.

TOLERANCES UNLESS OTHERWISE SPECIFIED	WILMORE ELECTRONICS CO., INC. DURHAM NORTH CAROLINA
DECIMAL	8339
SCALE	
DRAWN BY	D.W. COX
APPROVALS	
FUNCTIONAL	INTERFACE, ELECTRICAL, MODEL 1339
CONTRACT	25APRIL78 5300067

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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

QTY	USED ON	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH

DRAWN BY	C. ADKINS	DATE 1/29/79
CHECKER		
APPROVED	Wm. D. Fountain	1/30/79
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
ELECTRICAL INTERFACE, MY-32/34 CHARGING POWER SUPPLIES

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060151	5

SCALE | SHEET 1 OF

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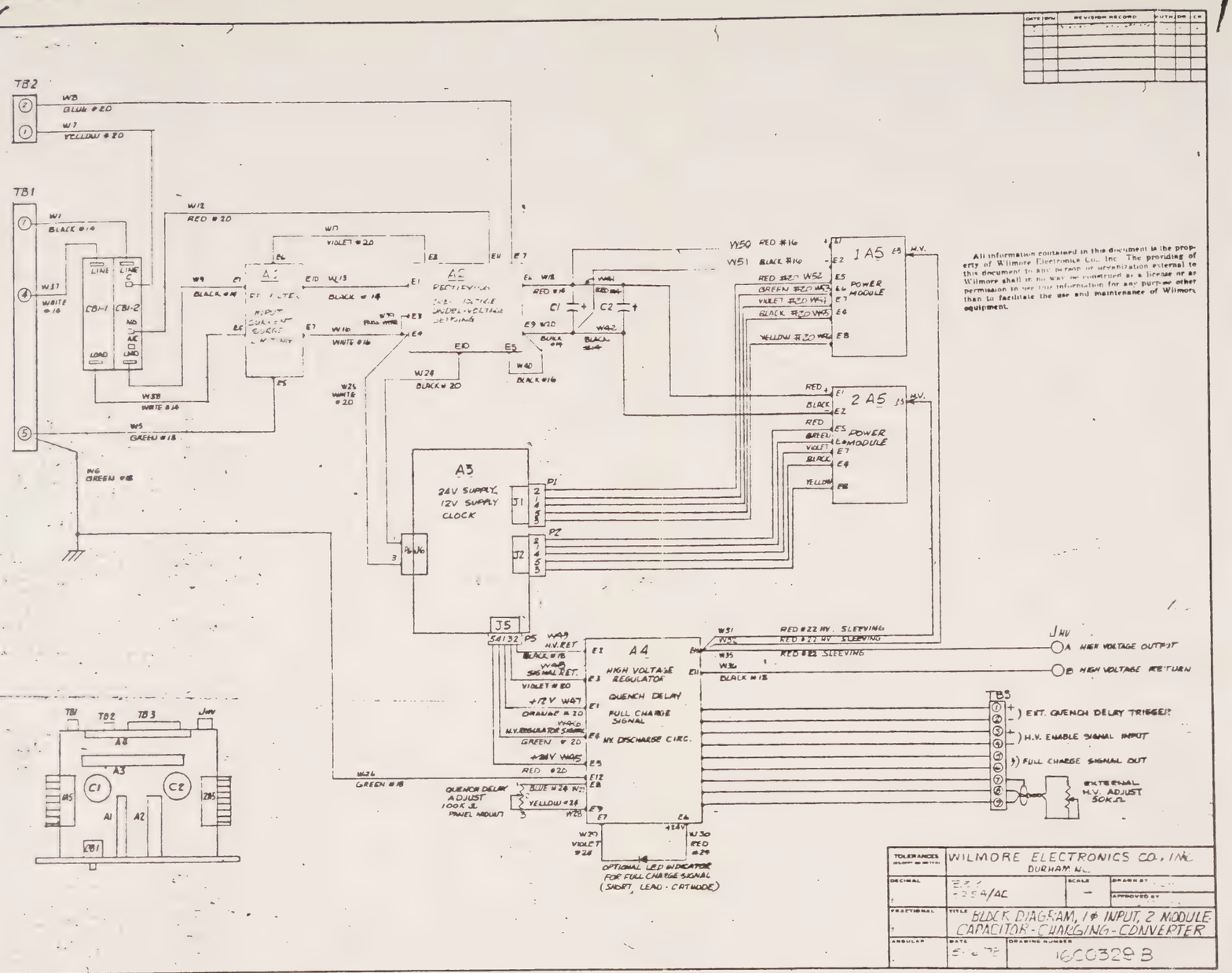
IN SHOP GRAPHICS/ACCUPRESS RED RIDER NO. 4-2857

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
D	REDRAWN PER ECO 2033	7-17-79	WNF



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TOLERANCES	WILMORE ELECTRONICS CO., INC. DURHAM, N.C.		
DECIMAL	SIZE 254/AC	SCALE —	DRAWN BY
FRACTIONAL	TITLE BLOCK DIAGRAM, 1Φ INPUT, 2 MODULE CAPACITOR-CHARGING-CONVERTER		APPROVED BY
ANGULAR	DATE 5-6-72	DRAWING NUMBER 1600329 B	

QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005 - .020
MATERIAL
FINISH

QTY | USED ON | NEXT ASSY | APPLICATION

DRAWN BY G. GULLIFORD	DATE 7/17/79	Molectron CORPORATION, 177 N WOLFE ROAD, SUNNYVALE CALIFORNIA 94086, (408) 738-2661
CHECKED	7-17-79	
APPROVED		
APPROVED		
CUSTOMER & SPEC		TITLE: BLOCK DIAGRAM, MY 32/34 OSC. CHARGING PWR SUPPLY
CONTRACT NO.		CODE IDENT NO 34285 · SIZE D · DWG NO. 060152 · REV D
SIMILAR TO		SCALE · SHEET 1 OF 1

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NOTES:

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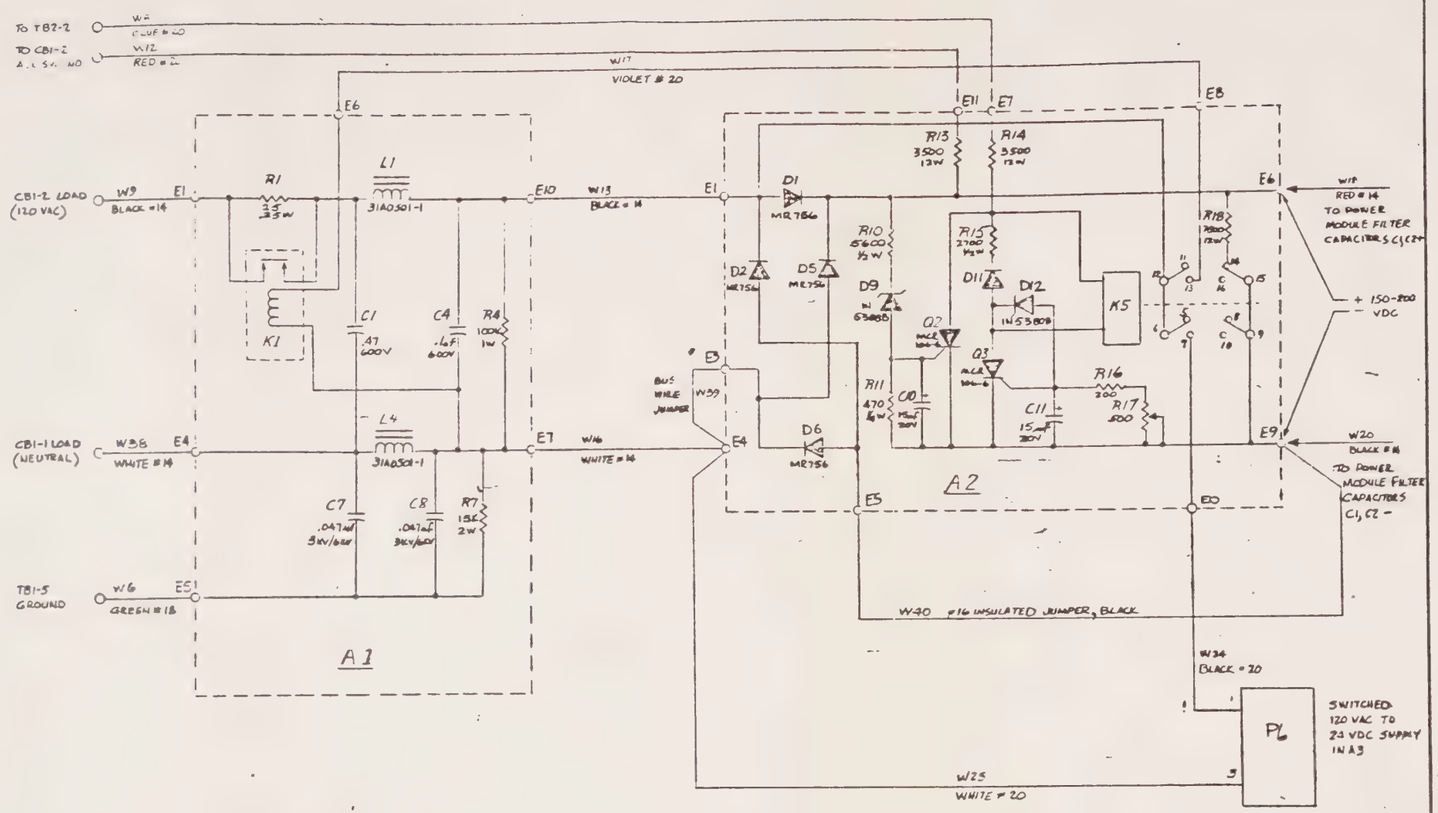
REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	1/23/79	WDF
B	RELEASE ECO#2004	9/13/79	WDF



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TOLERANCES			
DECIMAL	B339	SCALE	DRAWN BY
FRACTIONAL	TITLE SCHEMATIC DIAGRAM, A1 & A2, 10 INPUT CIRCUITS		APPROVED BY
ANGULAR	DATE 5-5-78	DRAWING NUMBER 16CD338A	

MADE IN U.S.A.

K-E ALBUQUERQUE - TO 5661 ENGINEERING STANDARD FORM

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QTY	USED ON	APPLICATION
	NEXT ASSY	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005 - .020
MATERIAL
FINISH

DRAWN BY C. HOKINS	DATE 1/23/79	Molectron CORPORATION	177 N. WOLFE ROAD SUNNYVALE, CALIFORNIA 94086 (408) 738-2661
CHECKER Wm. D. Fountain	1/30/79		
APPROVED		TITLE SCHEMATIC DIAGRAM, POWER CONDITIONING CIRCUITS, MY 32/34 OSC. CHARGING PWR SUPPLY	
APPROVED			
CUSTOMER & SPEC			
CONTRACT NO.		CODE IDENT NO. 34285	SIZE D
SIMILAR TO		DWG NO. 060153	REV B
		SCALE	SHEET OF

-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

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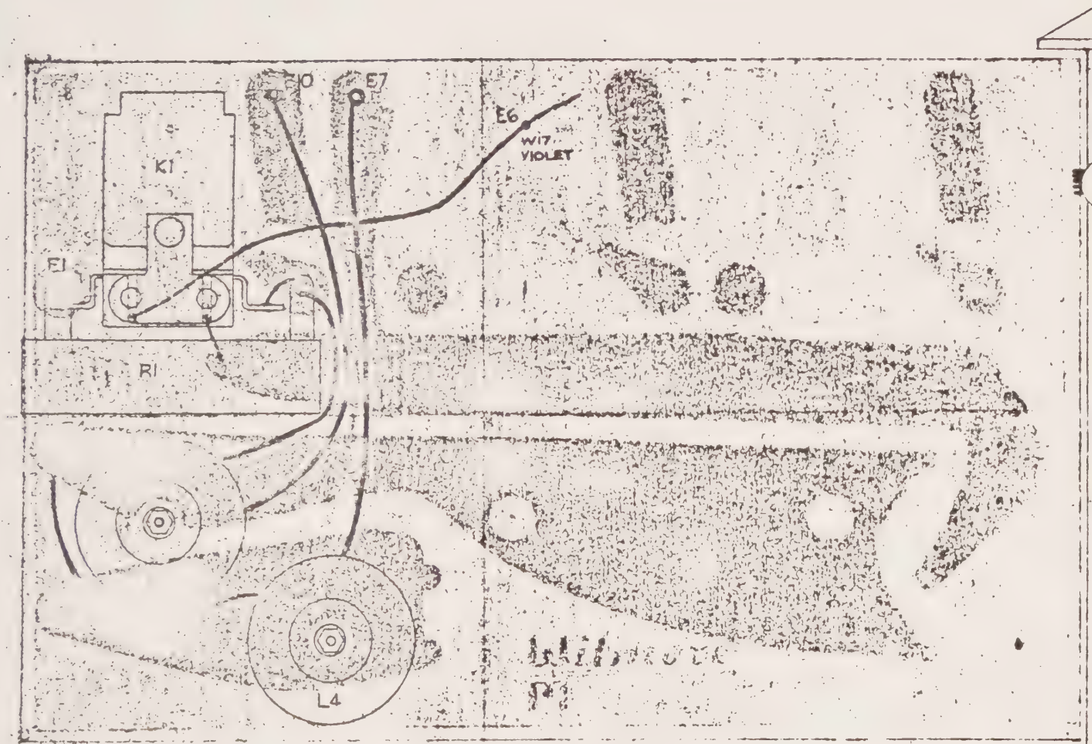
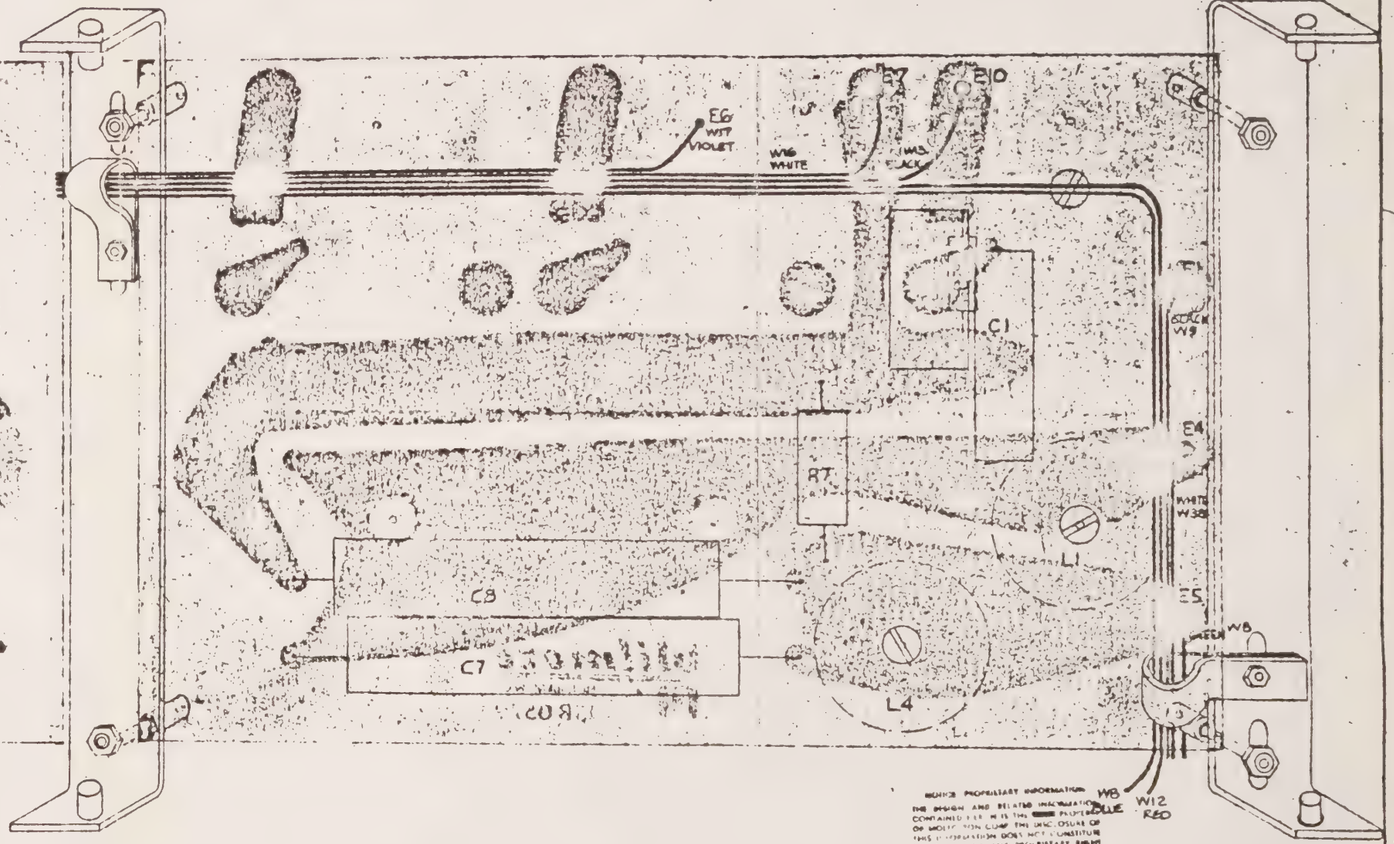
BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-4362

DATE/ECO	REVISION RECORD	APPR'D	CK
1/3/79 A	WIRE NOS. ADDED		BK

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	1/3/79	WDF
B	[illegible] 2004	4/3/79	[illegible]





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-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

DRAWN BY C. ADKINS	DATE 1/23/79	Molectron	177 N. WOLFE ROAD SUNNYVALE, CALIFORNIA 94086 (408) 738-2661
CHECKER			
APPROVED Wm. D. Fountain	1/29/79		
APPROVED			
CUSTOMER & SPEC		TITLE P.W.A. [illegible]	
CONTRACT NO.		CODE IDENT NO 34285	SIZE D
SIMILAR TO		DWG NO. 060154	REV B
		SCALE	SHEET 1 OF 1

APPLICATION	USED ON	NEXT ASSY
	QTY	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON –
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005 - .020
MATERIAL
FINISH

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TOLERANCES UNLESS OTHERWISE SPECIFIED	WILMORE ELECTRONICS CO., INC. DURHAM, NC		
DECIMAL ±	B339 B254/AC	SCALE —	DRAWN BY CCS
FRACTIONAL ±	TITLE COMPONENT ASSEMBLY A1, 1B INPUT FILTER, SURGE LIMITER		APPROVED BY
ANGULAR ±	DATE 10/4/78	DRAWING NUMBER 1200353A	

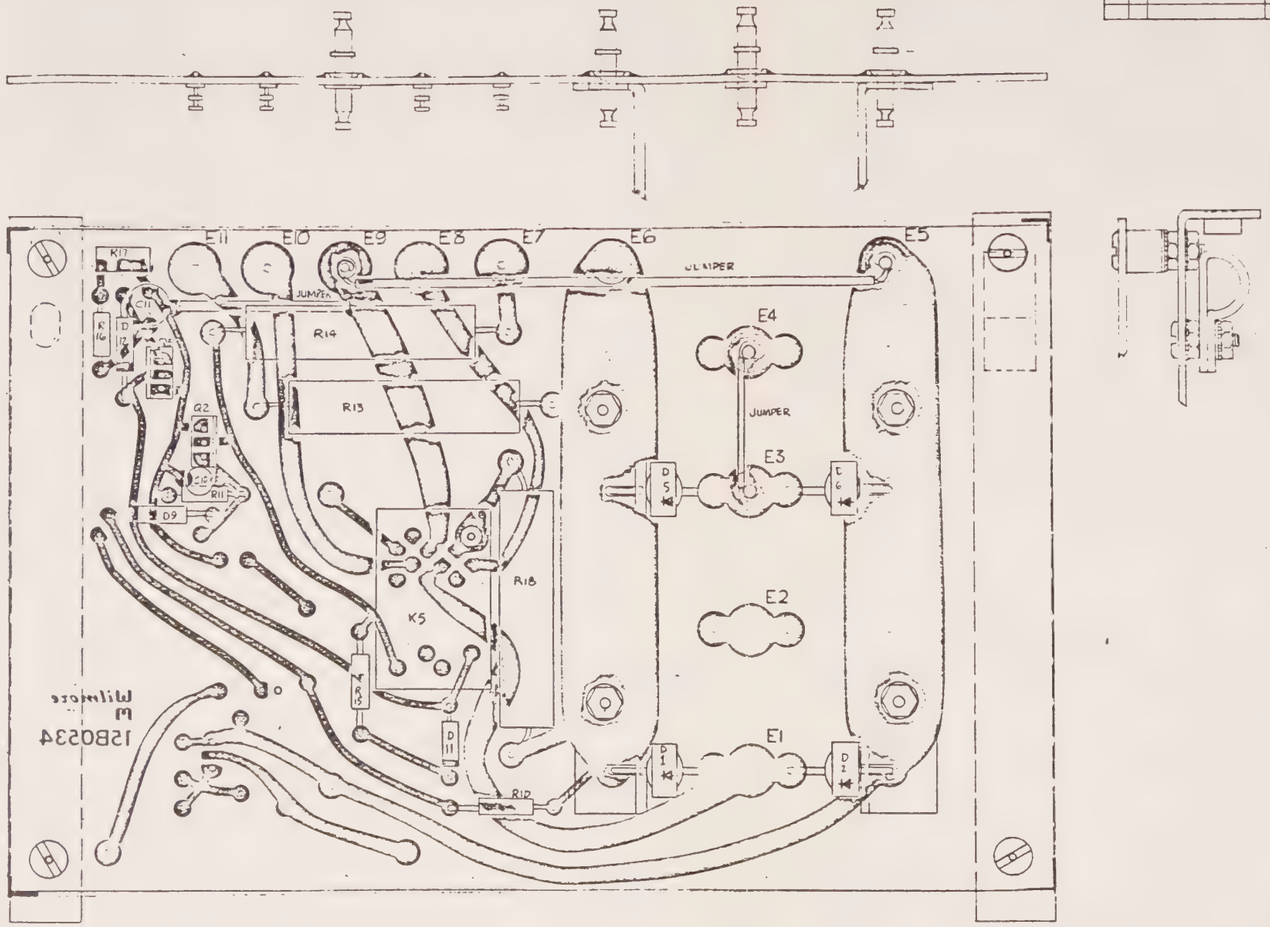
NOTES:

⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	1/24/79	WDF
B	RELEASE ECO#2009	4/13/79	WDF

DATE	LTR	REV RECORD	ECN	BY	CK
1-8-79	A	D1 WAS D3		WDF	



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TOLERANCES	DURHAM NC
DECIMAL	B339 B254/AC
SCALE —	DRAWN BY CLS
APPROVED BY	
FRACTIONAL	TITLE COMPONENT ASSEMBLY, A2 RECTIFIER/VOLTAGE SENSE, I
ANGULAR	DATE 10 6 78
DRAWING NUMBER	12C0352A

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-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

QTY	USED ON	NEXT ASSY	APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005 - .020

MATERIAL

FINISH

DRAWN BY C. ADKINS	DATE 1/24/79	Molectron CORPORATION, 177 N. WOLFE ROAD, SUNNYVALE, CALIFORNIA 94086, (408) 738-2661
CHECKER		
APPROVED Wm D. Fountain	1/31/79	
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

TITLE
PWA - A2, MY32/34 OSC. CHARGING POWER SUPPLY

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060155	B

SCALE | SHEET 1 OF 1

BISHOP GRAPHICS, ACCUPRESS REORDER NO. 34382

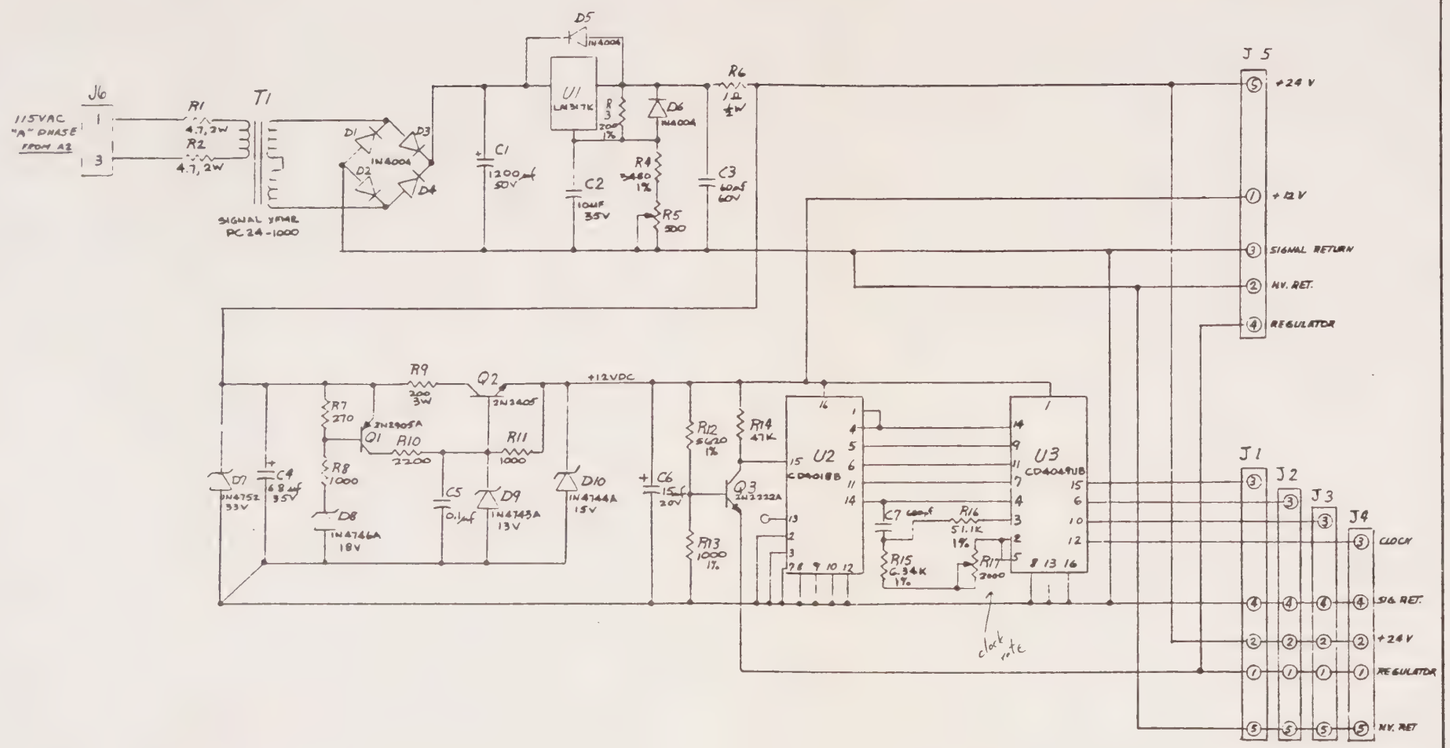
NOTES:

⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	1/15/79	WLF
B	RELEASE ECO#2004	4/13/79	WLF

DATE	BY	REVISION RECORD	AUTH	DR	CK



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TOLERANCES (UNLESS OTHERWISE NOTED)	WILMORE ELECTRONICS CO., INC.
DECIMAL .	2253 1254
SCALE —	DRAWN BY
	APPROVED BY
FRACTIONAL	TITLE: SCHEMATIC FOR SUBASSEMBLY A3 MODEL 1253 1254
ANGULAR .	DATE 5/17/79
	DRAWING NUMBER 162C33C

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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

QTY	USED ON	NEXT ASSY	APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005 - .020
MATERIAL
FINISH

		DATE
DRAWN BY	C ADKINS	1/25/79
CHECKER		
APPROVED	Wm. D. Fountain	1/25/79
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE: SCHEMATIC, CONTROL SUPPLIES & CLOCK, MY32/34 OSC. & AMP. CHARGING POWER SUPPLIES

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060156	B

SCALE | SHEET 1 OF 1

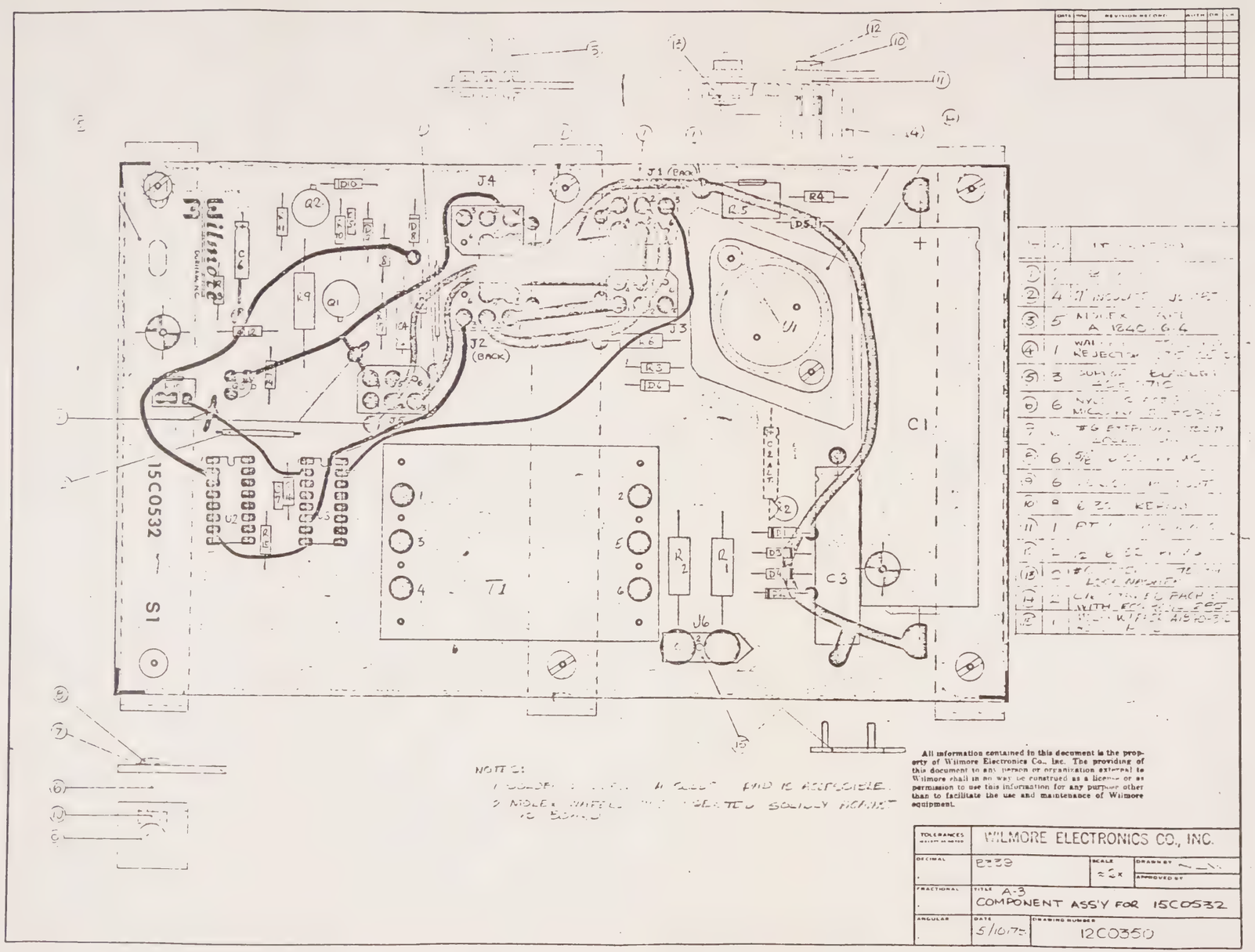
© BISHOP GRAPHICS / ACCUPRESS REDI-ROLER NO. A-9352

NOTES:

⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	7/20/79	WDF
B	RELEASE ECO# 2004	9/13/79	WDF



NOTES:

1 SOLDER [illegible] AS SHOWN AND IS ACCEPTABLE.

2 NYLON WASHER [illegible] MOUNTED SOLELY AGAINST TO BOARD

ITEM	QTY	PART NUMBER	DESCRIPTION	REF DESIG
1			PARTS LIST	
2	4	[illegible]	[illegible]	
3	5	[illegible]	[illegible]	
4	1	[illegible]	[illegible]	
5	3	[illegible]	[illegible]	
6	6	[illegible]	[illegible]	
7		[illegible]	[illegible]	
8	6	[illegible]	[illegible]	
9	6	[illegible]	[illegible]	
10	8	[illegible]	[illegible]	
11	1	[illegible]	[illegible]	
12	2	[illegible]	[illegible]	
13	2	[illegible]	[illegible]	
14	1	[illegible]	[illegible]	

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TOLERANCES	WILMORE ELECTRONICS CO., INC.
DECIMAL	B339
SCALE	2X
DRAWN BY	
APPROVED BY	
FRACTIONAL	TITLE A-3 COMPONENT ASS'Y FOR 15C0532
ANGULAR	DATE 5/10/75
DRAWING NUMBER	12C0350

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QTY		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON -	
USED ON		DEC .XX ±	ANG ±
		.XXX ±	FIN ✓
NEXT ASSY	APPLICATION	BREAK ALL SHARP EDGES .005 - .020	
		MATERIAL	
		FINISH	

DRAWN BY	C. ADKINS	DATE 1/24/79
CHECKER		
APPROVED	Wm. D. Fountain	1/24/79
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
PWA - A3, MY-32/34 OSC. & AMP CHARGING PWR SUPPLIES

CODE IDENT NO	SIZE	DWG NO.	REV
34285	D	060157	B

SCALE | SHEET 1 OF 1

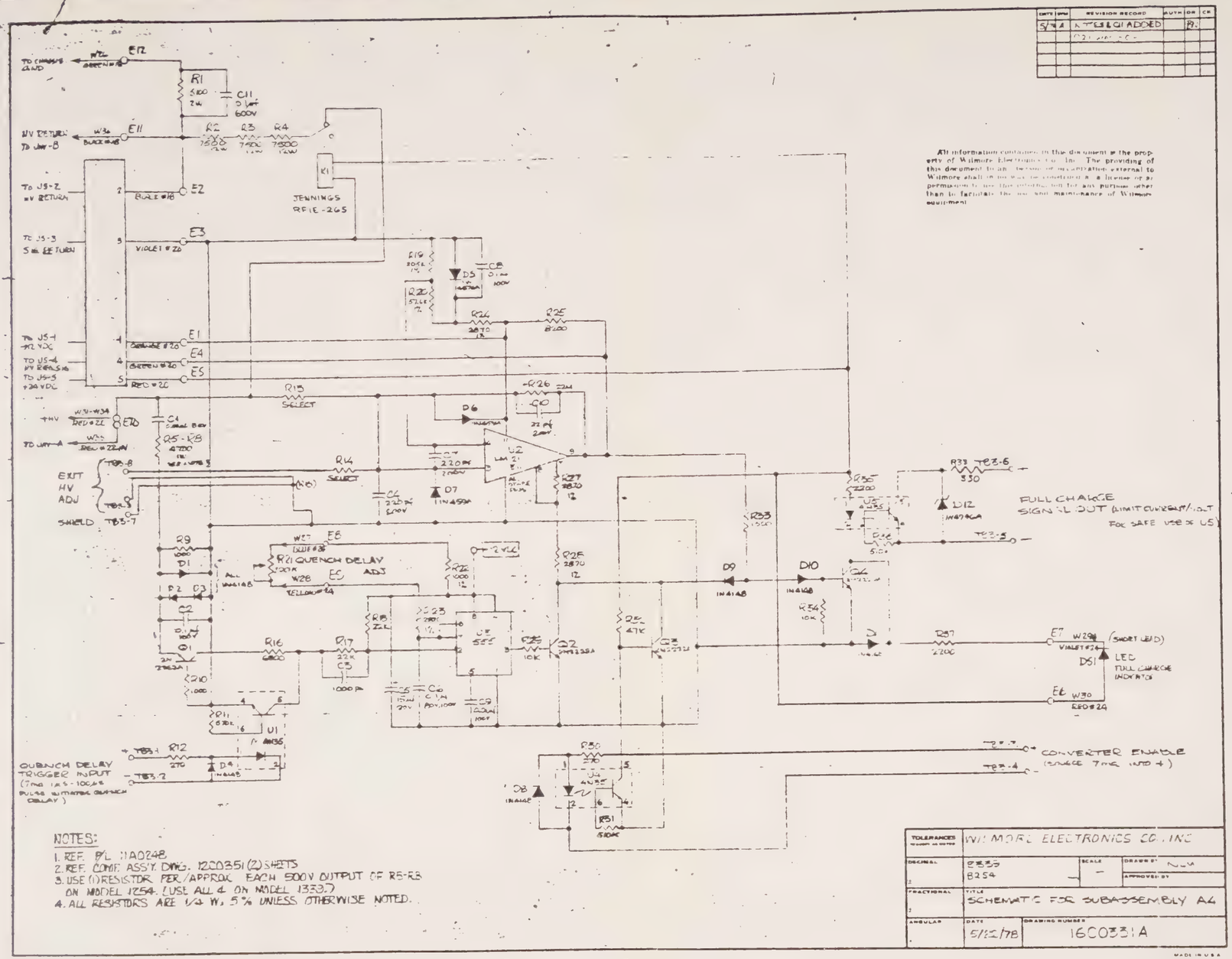
© BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A-4362

NOTES

⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
C	REDRAWN PER ECO 2033	7-17-79	[illegible]

DATE	APVD	REVISION RECORD	AUTH	DR	CK
5/24	A	[illegible] ADDED		RP	



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NOTES:
1. REF. P/L #1A0248.
2. REF. COMP. ASS'Y. DWG. 1200351 (2) SHEETS
3. USE (1) RESISTOR PER APPROX. EACH 500V OUTPUT OF R5-R8 ON MODEL 1254. (USE ALL 4 ON MODEL 1333.)
4. ALL RESISTORS ARE 1/2 W, 5% UNLESS OTHERWISE NOTED.

TOLERANCES	WILMORE ELECTRONICS CO., INC.		
DECIMAL	SIZE B	SCALE –	DRAWN BY NLM
FRACTIONAL	TITLE SCHEMATIC FOR SUBASSEMBLY A4		APPROVED BY
ANGULAR	DATE 5/22/78	DRAWING NUMBER 1600331A	

MADE IN U.S.A.

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ITEM	REF DESIG	DESCRIPTION	PART NUMBER	QUANTITY -4	-3	-2	-1

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN √
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH
APPLICATION: USED ON | NEXT ASSY | QTY

DRAWN BY G. GULLIFORD	DATE 7/17/79	
CHECKER [signature]	7-17-79	
APPROVED [illegible]		
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE CALIFORNIA 94086
(408) 738 2661

TITLE
SCHEMATIC, HIGH VOLTAGE CIRCUITS, MY32/34 OSC. & AMP. CHARGING POWER SUPPLIES

CODE IDENT NO	SIZE	DWG NO.	REV
34285	D	060158	C

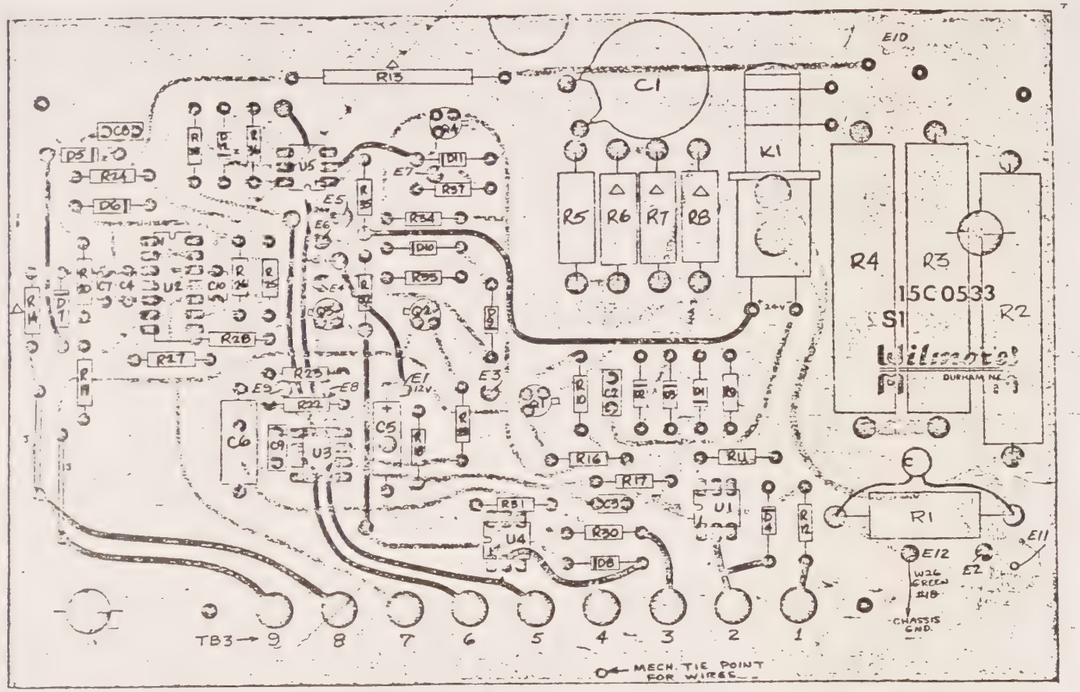
SCALE | SHEET 1 OF 1

NOTES:

⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	1/31/79	WDF
B	REL. ECO#2004	4/12/79	WDF



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TOLERANCES UNLESS SPECIFIED	WILMORE ELECTRONICS CO. INC.	
DECIMAL	SCALE	DRAWN BY
FRACTIONAL	TITLE: COMPONENT ASSY-HV REGULATOR BD S/A A4	APPROVED BY
ANGULAR	DATE	DRAWING NUMBER: 12C0351

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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

USED ON	QTY	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON -	
NEXT ASSY	APPLICATION	DEC .XX ±	ANG ±
		.XXX ±	FIN √
		BREAK ALL SHARP EDGES .005-.020	
		MATERIAL	
		FINISH	

DRAWN BY C. ADKINS	DATE 1/25/79	Molectron CORPORATION	177 N WOLFE ROAD SUNNYVALE, CALIFORNIA 94086 (408) 738-2661
CHECKER			
APPROVED Wm. D. Fountain	1/25/79	TITLE: PWA #A4, MY32/34 OSC. & AMP. CHARGING POWER SUPPLIES	
APPROVED			
CUSTOMER & SPEC			
CONTRACT NO.			
SIMILAR TO			

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060159	B
SCALE		SHEET 1 OF 1	

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NOTES:

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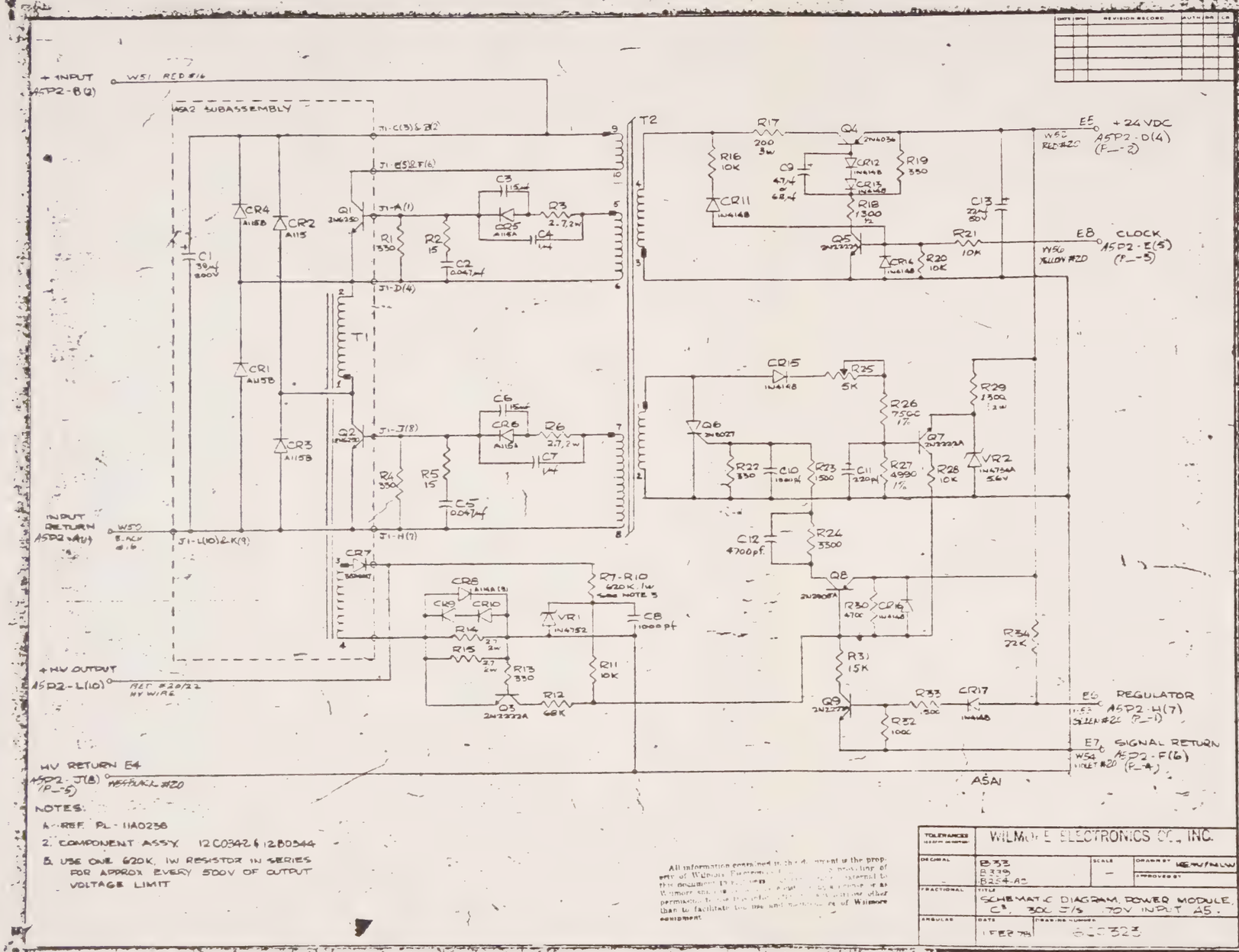
DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
B	REDRAWN	2-20-79	WDF
C	REL ECO #1004	4/12/79	WDF



NOTES:

1. REF PL-11A0238
2. COMPONENT ASSY. 12C03426 12B0344
3. USE ONE 620K, 1W RESISTOR IN SERIES FOR APPROX EVERY 500V OF OUTPUT VOLTAGE LIMIT

DATE	BY	REVISION RECORD	AUTH	QA	CA

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TOLERANCES UNLESS OTHERWISE SPECIFIED	WILMORE ELECTRONICS CO., INC.	
DECIMAL	B33, B339, B254-A2	SCALE — DRAWN BY WE-WJ/WLW APPROVED BY
FRACTIONAL	TITLE SCHEMATIC DIAGRAM, POWER MODULE, C^{R}, 300 S/S 70V INPUT A5.	
ANGULAR	DATE 1 FEB 79	DRAWING NUMBER B-5323

-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

QTY	USED ON	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN √
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH

DRAWN BY	DATE
G. ADKINS	1/29/79
CHECKER	
APPROVED	
APPROVED	
CUSTOMER & SPEC	
CONTRACT NO.	
SIMILAR TO	

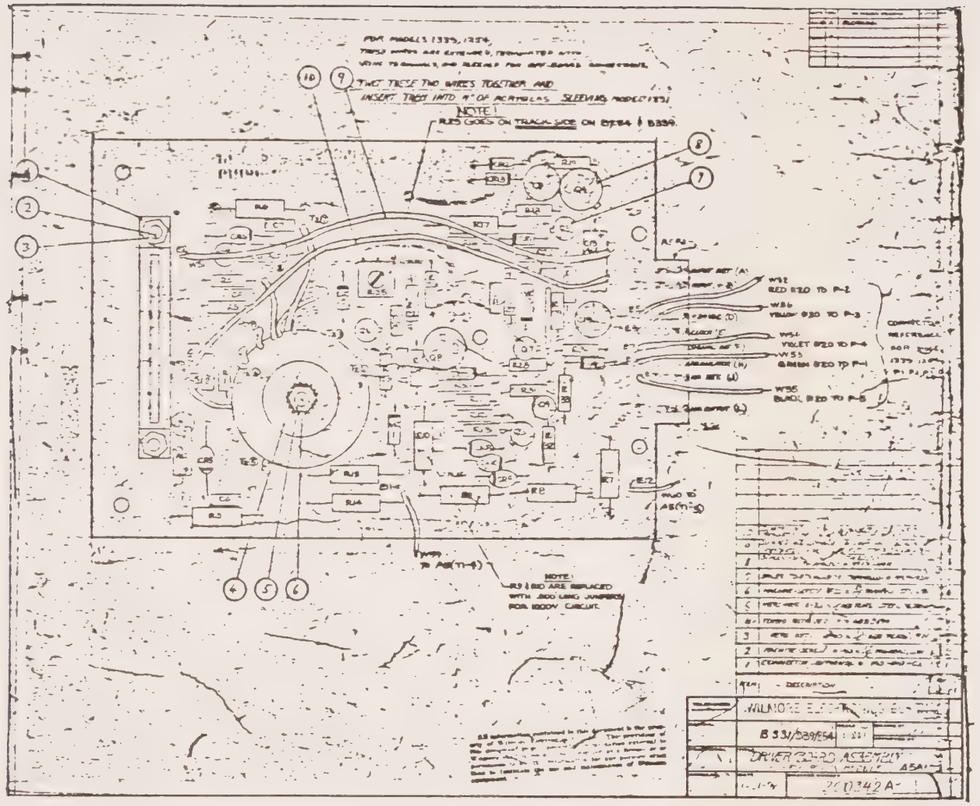
Molectron CORPORATION
1771 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-7661

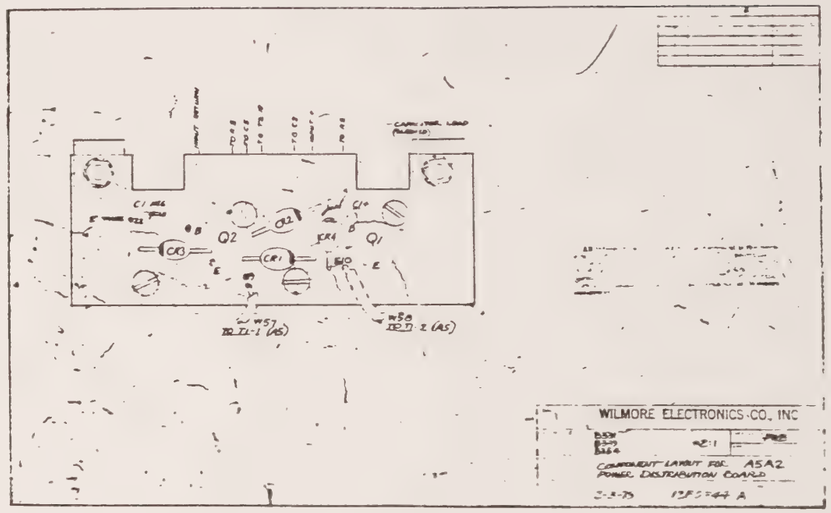
TITLE
SCHEMATIC POWER MODULE MY2-134 CHARGING PWR SUPPLIES

CODE IDENT NO	SIZE	DWG NO	REV
34285	D	26060	C

SCALE — SHEET — OF —

LTR	DESCRIPTION	DATE	APPD
A	REDRAWN	2 20 79	





QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
		PARTS LIST		

DRAWN BY	DHM	DATE 2-20-79
CHECKER		
APPROVED	Wo Linta	3/1/79
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DEC .XX ±; ANGLE ±; KEY: F/N; BREAK ALL SHARP EDGES .005 .01; MATERIAL; FINISH

Molectron

TITLE: P.W.A. #A5, MY 327.24 CHARGING POWER SUPPLY

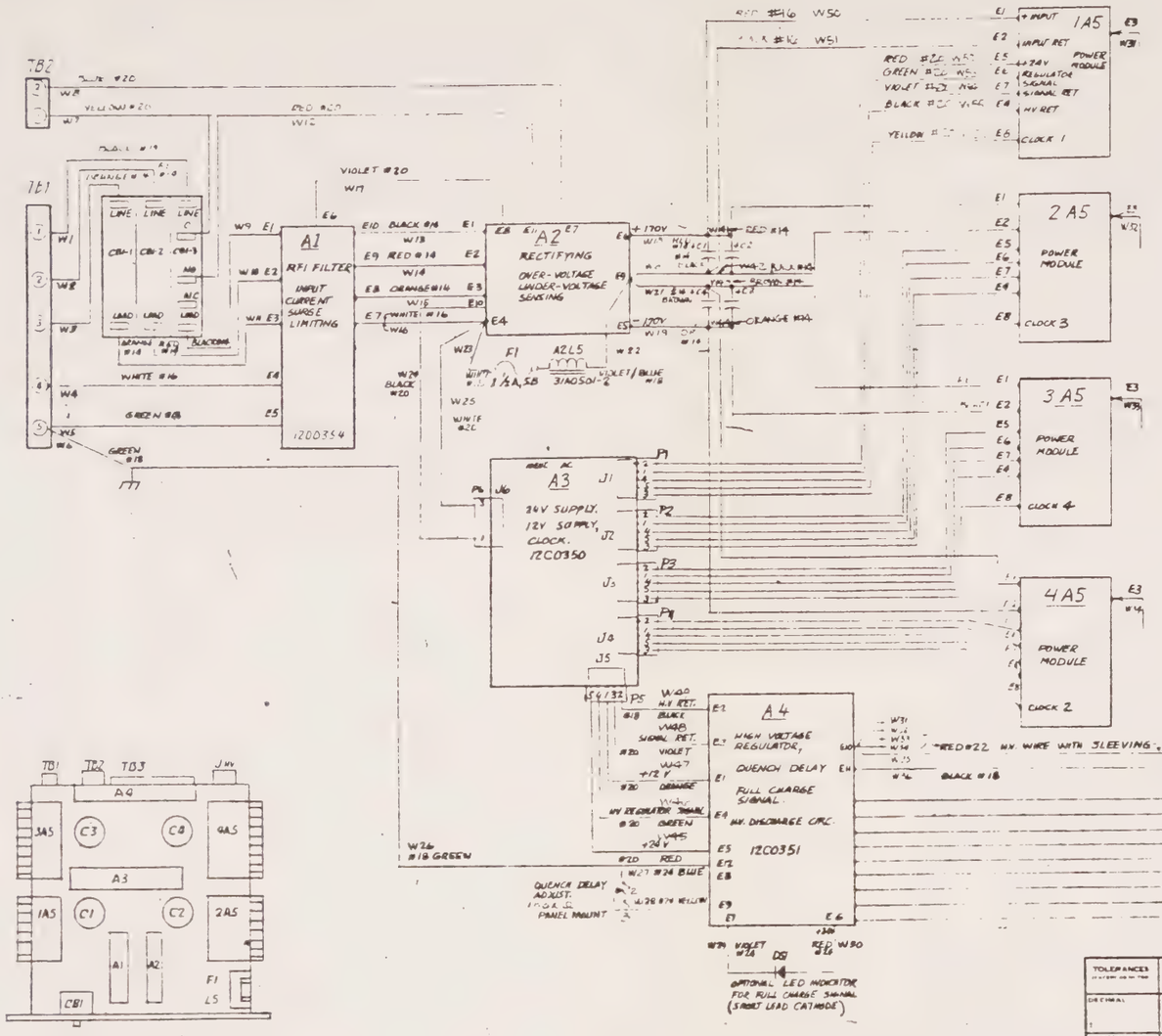
CODE IDENT NO.	SIZE	DWG. NO.	REV.
34285	E	C30161	C

SCALE | SHEET

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
D	REDRAWN PER ECO 2033	7-17-73	



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TOLERANCES	WILMORE ELECTRONICS CO., INC. DURHAM N.C.		
DECIMAL	3339 B254 A/C	SCALE	DRAWN BY A
FRACTIONAL	TITLE BLOCK DIAGRAM 3ØAC INPUT, 4 M. MULT. CAPACITOR CHARGING CONVERTER		APPROVED BY
ANGULAR	DATE	DRAWING NUMBER ECO327 B	

MADE IN U.S.A.

-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

QTY			
USED ON			
NEXT ASSY			

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN √
BREAK ALL SHARP EDGES .005 - .020

MATERIAL

FINISH

DRAWN BY	G. GUILFORD	DATE 7-10-73
CHECKER		7/17/73
APPROVED		
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE CALIFORNIA 94086
(408) 738 2661

TITLE
BLOCK DIAGRAM, MY 34 AMP. CHARGING PWR. SUPPLY

CODE IDENT NO	SIZE	DWG NO	REV
34285	D	060162	D

SCALE

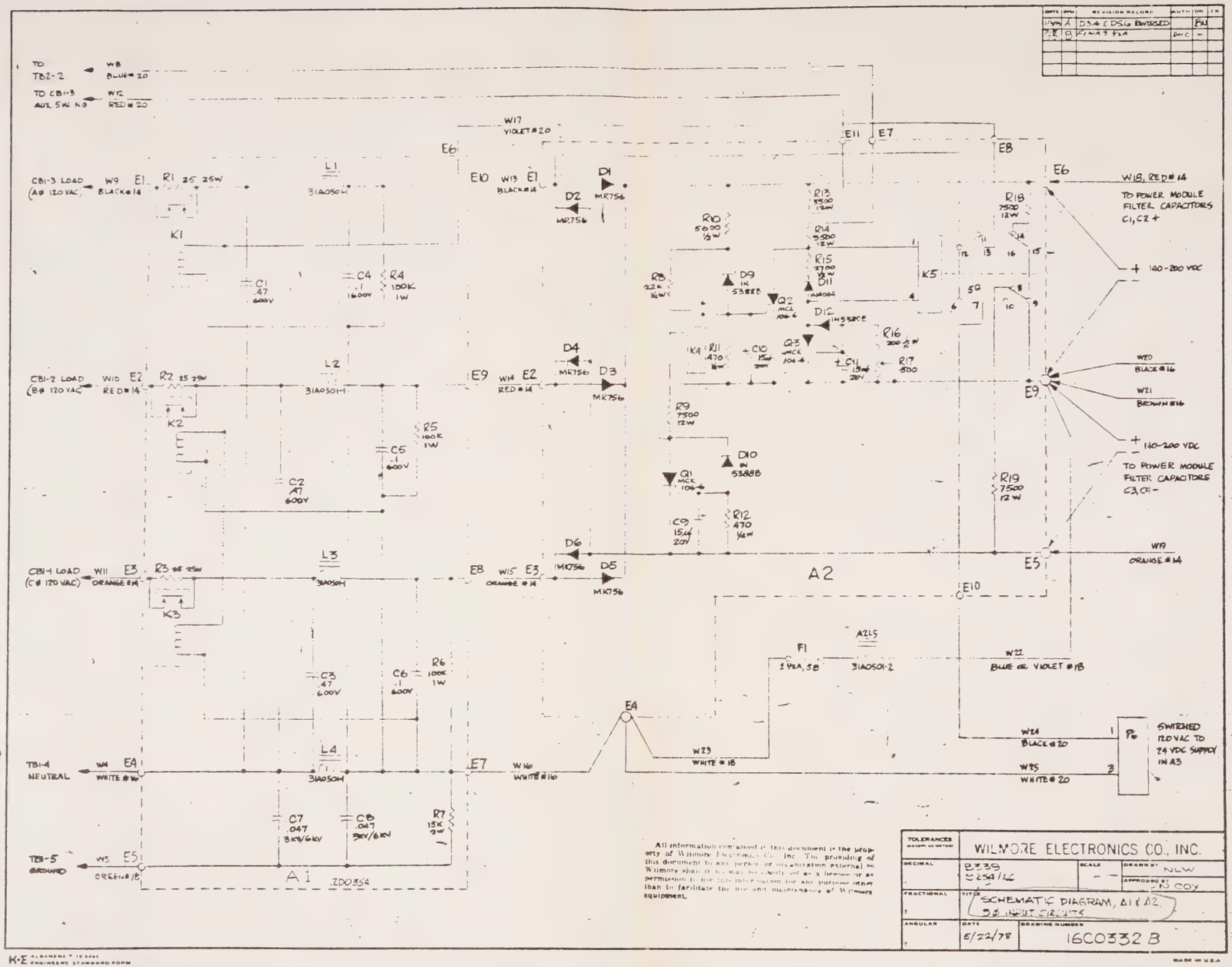
SHEET 1 OF 1

NOTES

⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
C	REDRAWN PER ECO 2033	7-17-79	WLF

DATE	DWN	REVISION RECORD	AUTH	CHK
11/7/78	A	D3 & D5 & D6 REVERSED		PAL
7/18/79	B	PWR & SW	DWC	



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TOLERANCES UNLESS AS NOTED	WILMORE ELECTRONICS CO., INC.	
DECIMAL ±	SCALE — —	DRAWN BY NLW
FRACTIONAL ±	TITLE SCHEMATIC DIAGRAM, A1 & A2 3Ø INPUT CIRCUITS	APPROVED BY N COX
ANGULAR ±	DATE 6/22/78	DRAWING NUMBER 16C0332 B

MADE IN U.S.A.

K-E ALBANENE # 10 5461 ENGINEERS STANDARD FORM

QTY	USED ON	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN √
BREAK ALL SHARP EDGES .005-.020

MATERIAL

FINISH

QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

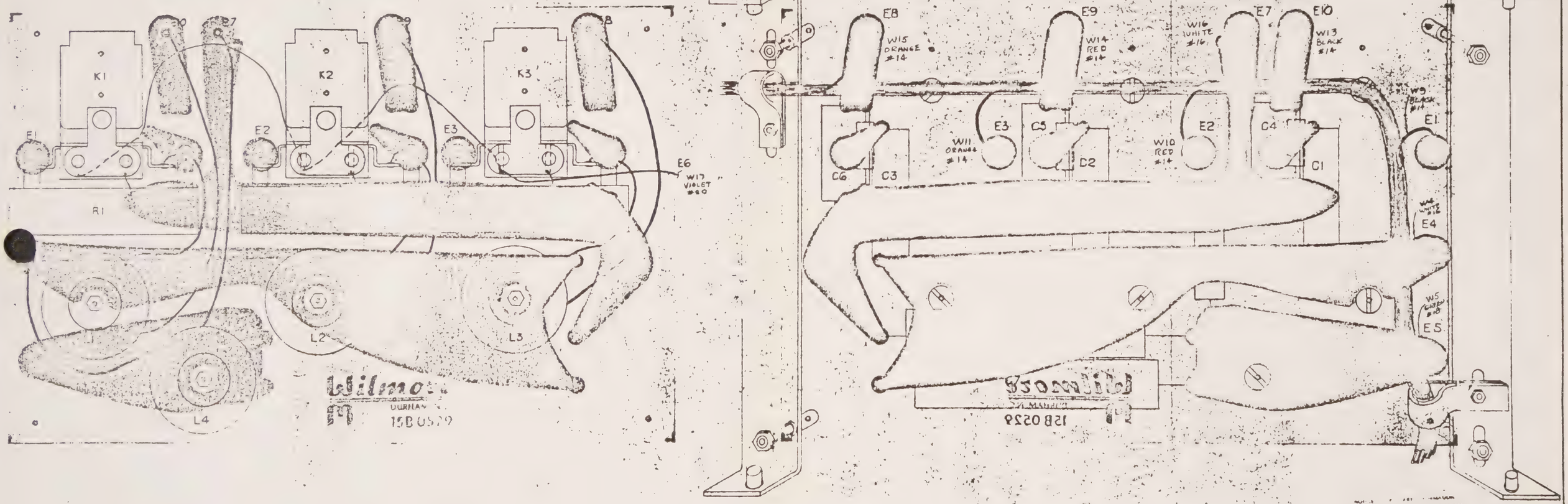
PARTS LIST

DRAWN BY S. GULLIFORD	DATE 7/17/79	Molectron CORPORATION, 177 N. WOLFE ROAD, SUNNYVALE CALIFORNIA 94086, (408) 738-2961
CHECKED		
APPROVED		TITLE: SCHEMATIC, PWR CONDITIONING CIRCUITS, MY 34 AMP CHARGING POWER SUPPLY
APPROVED		
CUSTOMER & SPEC		CODE IDENT NO 34285 · SIZE D · DWG NO. 060163 · REV C
CONTRACT NO.		SCALE · SHEET 1 OF 1
SIMILAR TO		

© BISHOP GRAPHICS/ACCUPRESS RECORDER NO. 1-6982

REVISIONS			
LTR	DESCRIPTION ECO	DATE	APPROVED

DATE	BY	REVISION RECORD	AUTH	DR.	CK.



QTY	USED ON	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DEC XX ± ANG ±
XXX ± FIN ✓
BREAK ALL SHARP EDGES .005 .020

MATERIAL

FINISH

4	3	2	1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
					PARTS LIST			

DRAWN BY [illegible] DATE [illegible]
CHECKER
APPROVED [illegible]
APPROVED
CUSTOMER & SPEC
CONTRACT NO
SIMILAR TO

Molectron
1771 N. REPE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-7661

TITLE
P.N. AI. MY 34 AMP
CHARGING POWER SUPPLY

CODE IDENT NO	SIZE	DWG NO	REV
34285		060164	E

SCALE SHEET 1 OF 1

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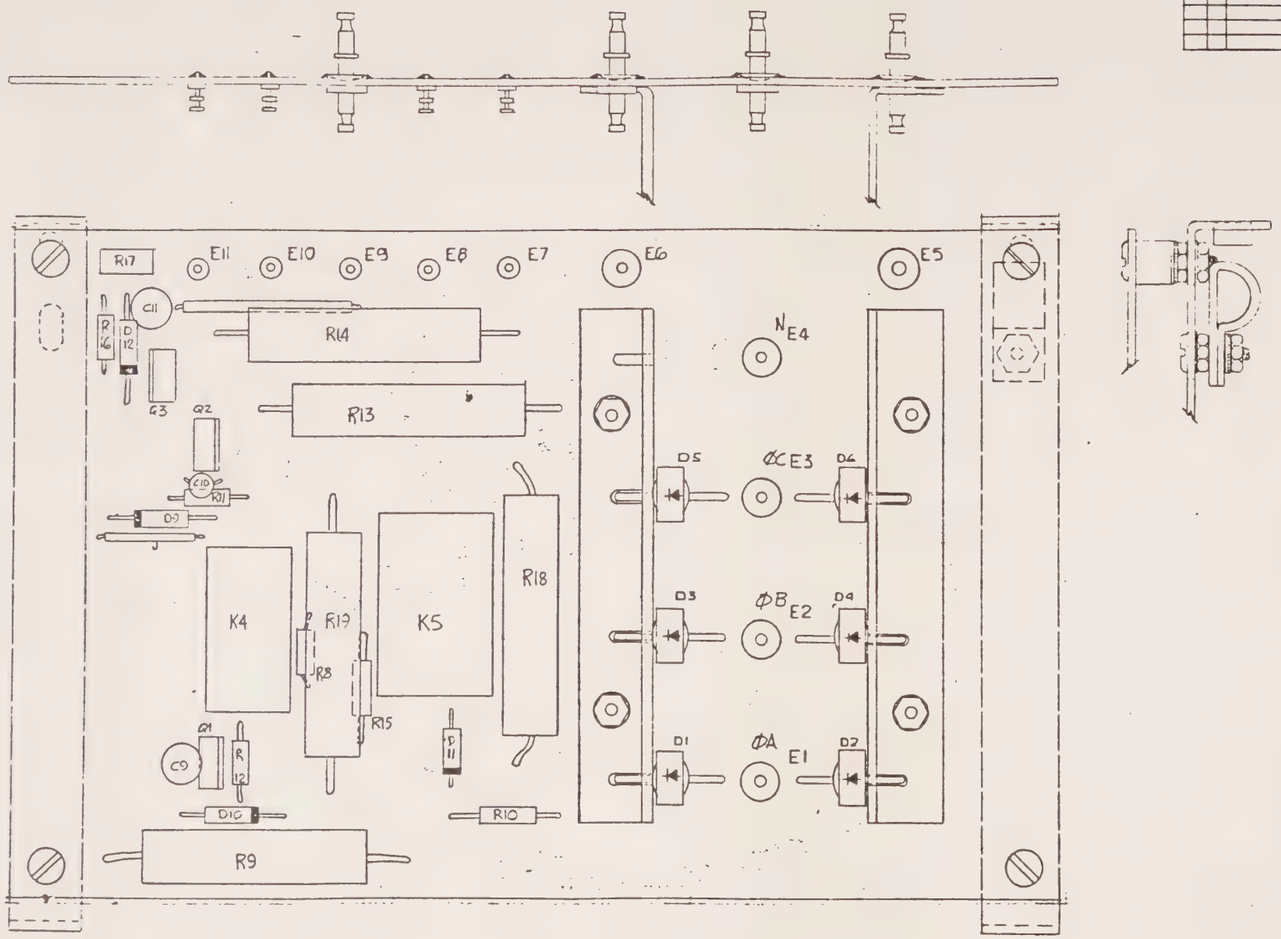
TOLERANCES (EXCEPT AS NOTED)	WILMORE ELECTRONICS CO., INC. DURHAM, NC.	
DECIMAL ±	B339 B254/AC	SCALE — DRAWN BY CLS APPROVED BY
FRACTIONAL ±	TITLE COMPONENT ASSEMBLY AI, 3Φ INPUT FILTER, SURGE LIMITER	
ANGULAR ±	DATE 9/8/78	DRAWING NUMBER 200354

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	1/25/79	WDF
B	REL. ECO# 2004	4/12/79	WDF



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TOLERANCES (EXCEPT AS NOTED)	WILMORE ELECTRONICS CO., INC. DURHAM N.C.
DECIMAL ±	B339 B254/AC
SCALE —	DRAWN BY CLS
FRACTIONAL ±	APPROVED BY
ANGULAR	TITLE COMPONENT ASSEMBLY A2 RECTIFIER VOLTAGE SENSE 3Ø
	DATE 10/5/78
	DRAWING NUMBER 12C0395

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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

QTY	USED ON	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON –
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005-.020

MATERIAL

FINISH

DRAWN BY C. LOKINS	DATE 1/25/79	
CHECKER		
APPROVED Wm. D. Fountain	1/25/79	
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
PWA, A2, MY34 AMP. CHARGING POWER SUPPLY

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060165	B

SCALE — SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-8352

NOTES

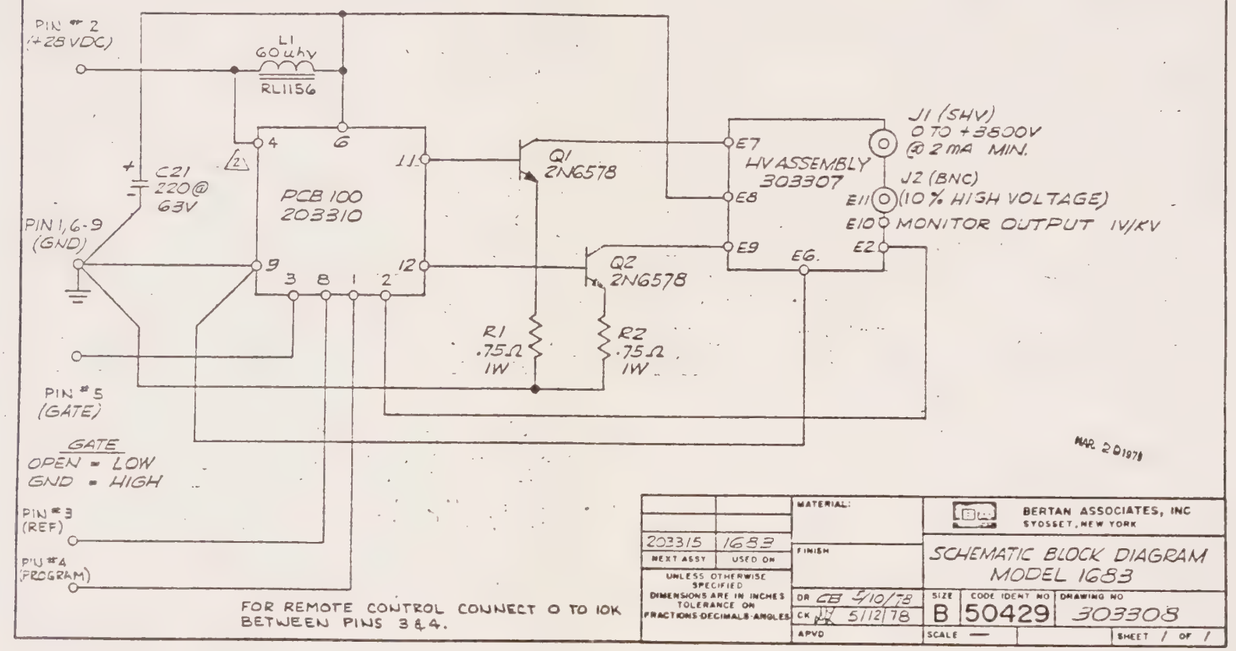
1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.
2. TIE POINT ON CARD EDGE CONNECTOR, NO INTERNAL CONNECTION.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
B	REDRAWN - REL. ECO # 2004	4/19/79	GK
C	ECO # 2095	11-8-79	WLF

LTR	REVISIONS	DATE	APPROVED
A	SEE ECN C40	[illegible]	[illegible]
B	ADDED PROGRAMMING	10/9/78	[illegible]
C	SEE ECN 738 &ECN 1115/79	11/15/79	[illegible]
D	PINS 6-9 ADDED TO GND	2/12/79	[illegible]

INPUT/CONTROL CONNECTOR


PIN # 2 (+28 VDC)
L1 60 uHY RL1156
C21 220@ 63V
PCB 100 203310
Q1 2N6578
Q2 2N6578
HV ASSEMBLY 303307
J1 (SHV) 0 TO +3500V @ 2 mA MIN.
J2 (BNC) (10% HIGH VOLTAGE) MONITOR OUTPUT 1V/KV
PIN 1, 6-9 (GND)
R1 .75Ω 1W
R2 .75Ω 1W
PIN # 5 (GATE)
GATE OPEN = LOW GND = HIGH
PIN # 3 (REF)
PIN # 4 (PROGRAM)
FOR REMOTE CONTROL CONNECT 0 TO 10K BETWEEN PINS 3 & 4.

MAR 20 1978

203315	1683
NEXT ASSY	USED ON

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON FRACTIONS DECIMALS ANGLES

MATERIAL:

FINISH

DR GB 5/10/78

CK [illegible] 5/12/78

APVD

BERTAN ASSOCIATES, INC SYOSSET, NEW YORK

SCHEMATIC BLOCK DIAGRAM MODEL 1683

SIZE	CODE IDENT NO	DRAWING NO
B	50429	303308

SCALE —

SHEET 1 OF 1

NOTICE - PROPRIETARY INFORMATION
THE DESIGN AND RELATED INFORMATION CONTAINED HEREIN IS THE [redacted] PROPERTY OF MOLECTRON CORP. THE DISCLOSURE OF THIS INFORMATION DOES NOT CONSTITUTE THE RELEASE OF ANY PROPRIETARY RIGHT THEREIN. PERMISSION TO REPRODUCE THE INFORMATION OR THE PRODUCTS ITS CLOSED HEREIN MUST BE OBTAINED IN WRITING FROM MOLECTRON CORP.

-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

			QTY
			USED ON
			NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON -
DEC .XX ± ANG ± FIN √
.XXX ± BREAK ALL SHARP EDGES .005 - .020

MATERIAL —

FINISH —

		DATE
DRAWN BY	[illegible]	4/19/79
CHECKER		
APPROVED	[illegible]	4/19
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD SUNNYVALE, CALIFORNIA 94086 (408) 738 2661

TITLE
SCHEMATIC BLOCK DIAGRAM
MY 32/34 POCKELS CELL
HIGH VOLTAGE SUPPLY

CODE IDENT NO	SIZE	DWG NO	REV
34285	D	060228	C

SCALE

SHEET 1 OF

© B-SHC P GRAPHICS ACCUPRESS REORDER NO. A4336

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

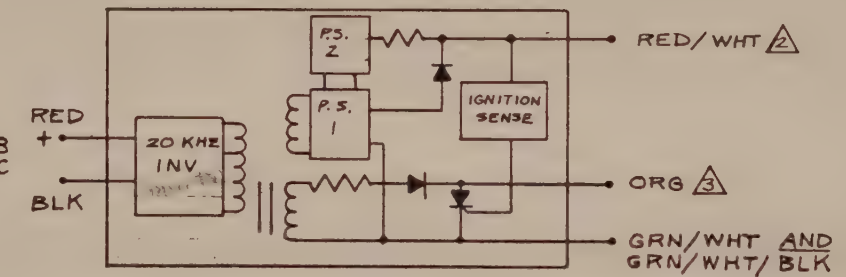
2. ROUGHLY + 1600 V PEAK DC @ 0 mA; ROUGHLY + 350 VDC @ 50 MADC SIMMER CURRENT.

3. ROUGHLY +250 VDC

4. AUTOIGNITION CIRCUITS WILL TRIGGER @ 30 HZ UNTIL IGNITION IS SENSED OR UNTIL SUPPLY FAILURE; DO NOT APPLY POWER TO SUPPLY IF ANY PART OF LAMP-SIMMER AND/OR LAMP-IGNITION CIRCUITRY IS INCOMPLETE.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	2-23-79	WDF
B	RELEASE ECO# 2004	4/13/79	WDF



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-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

QTY	USED ON	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005-.020

MATERIAL

FINISH

DRAWN BY	DHH	DATE 2-28-79
CHECKER		
APPROVED	Wm. D. Fountain	3/2/79
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
BLOCK DIAGRAM, SIMMER POWER SUPPLIES

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	B	060231	B

SCALE

SHEET 1 OF 1

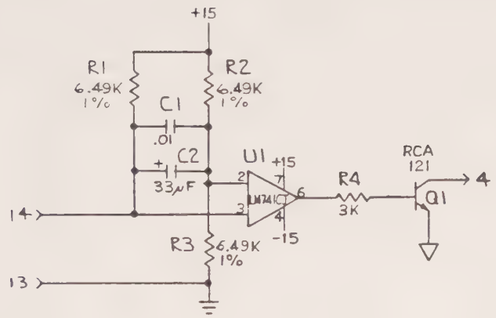
BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-8349

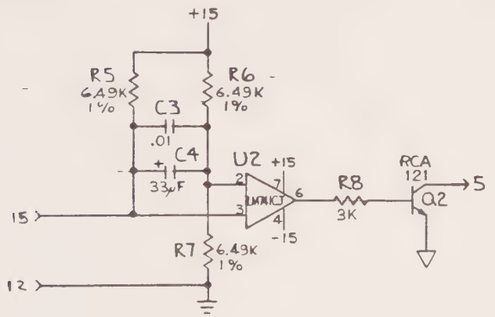
NOTES:

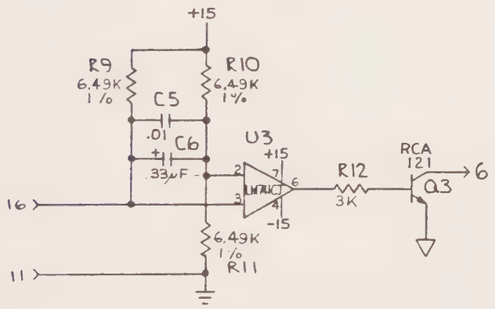
⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

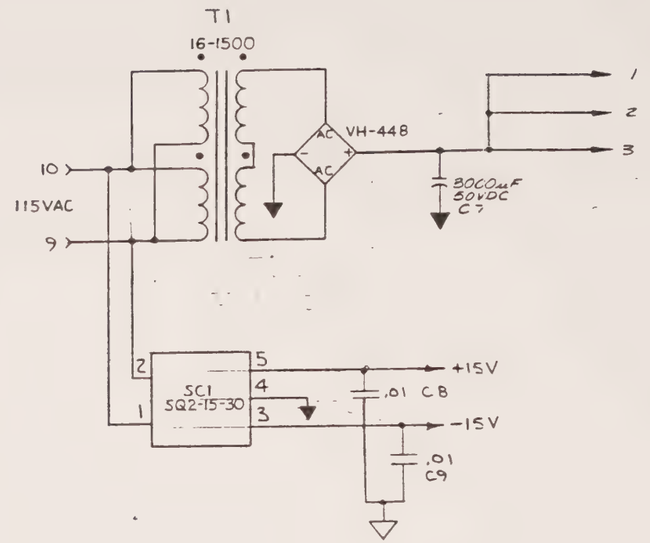
DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	RELEASE ECO #2004	4/12/79	
B	ECO # 2228	3/5/80	
C	ECO #2839	11/23/81	WDF









NOTICE - PROPRIETARY INFORMATION
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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

QTY	1		
USED ON	MV-3x		
NEXT ASSY	060028		
APPLICATION			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005-.020

MATERIAL —

FINISH —

DRAWN BY	G.S.	DATE 8/1/78
CHECKER		
APPROVED		4-79
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
YAG OVEN
CONTROLLER SCHEMATIC

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060337	C

SCALE — SHEET 1 OF 1

© B SHOP GRAPHICS/ACCUPRESS REORDER NO. A-6362

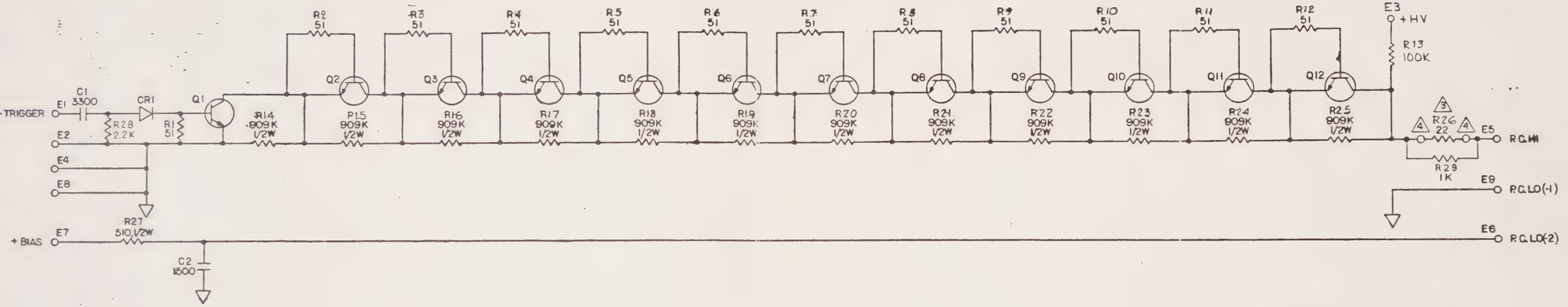
991749

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	REL-ECO# 2004	4/12/79	WDF
B	ECO # 2106	11-8-79	WDF
C	ECO • 2668	5/28/81	WDF

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.
2. UNLESS OTHERWISE INDICATED:
   CAPACITOR VALUES ARE IN PF,
   DIODES ARE IN4864,
   INDUCTOR VALUES ARE IN ___,
   RESISTOR VALUES ARE IN OHMS, 1/4 W, 5 %,
   TRANSISTORS ARE 2N5551.
3. WHEN LASER HAS MY-SAM OPTION #/OR MY-SP OPTION, R26 IS DELETED (OPEN).
4. UNMARKED "E"-TYPE TERMINAL.



REFERENCE DESIGNATORS		
FIRST	LAST	DELETED
C1	C2	—
CR1	CR1	—
E1	E9	—
Q1	Q12	—
R1	R29	—

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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

REF	QTY		
MY-SX	USED ON		
060017	NEXT ASSY	APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± — ANG ± —
.XXX ± — FIN √
BREAK ALL SHARP EDGES .005-.020
MATERIAL: SEE P/L OF 060017
FINISH: —

DRAWN BY	MKING	DATE 9-23-77
CHECKER	WDF	9/23/77
APPROVED		
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE: SCHEMATIC, POCKELS CELL DRIVER

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060340	C

SCALE — SHEET / OF /

990971

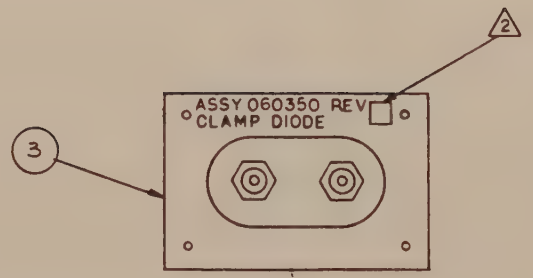
© SHOP GRAPHICS ACCUPRESS REORDER NO. A-0282

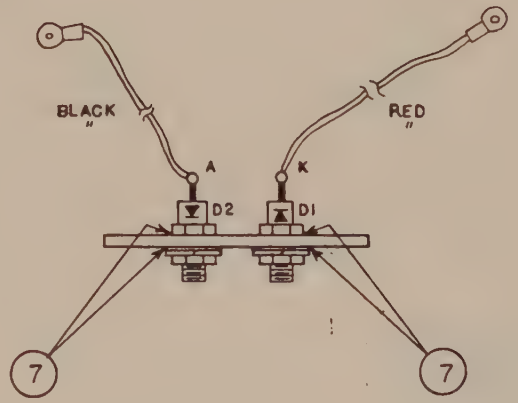
DO NOT SCALE DRAWING

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.
2. WRITE IN CURRENT REVISION LEVEL IN BLACK INK.

LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	9-28-78	GRC
B	PROD. REL. ECO #2004	4/11/79	GRC
C	ECO # 2042	9/11/79	WDF
D	ECO # 2439	9/9/80	WDF
E	ECO# 2564	5/28/81	WDF





NOTICE - PROPRIETARY INFORMATION
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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

2	1	QTY	
MY-345	MY-323	USED ON	
060023-2	060023-1	NEXT ASSY	

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH

		DATE
DRAWN BY	GR CANTU	9-28-78
CHECKER		9/11/79
APPROVED		9/79
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
DIODE CLAMP ASSY & SCHEMATIC
PULSED YAG

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	C	060350	E

SCALE | SHEET 1 OF 2

991812

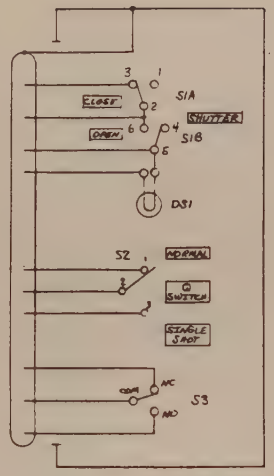
BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-8361

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.
2. ONE SECTION USED
3. GROUND ALL SHIELDS TO BOX

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	ADDED ITEMS 6 & 7	6/20/78	WCF
B	REVISED S3 TO SPDT	9/13/78	GRC
C	RELEASE ECO #2004	4/13/79	



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QUANTITY -4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
1				ALCO # C-13	BUTTON, LARGE, BLACK PLASTIC	USED WITH S3	7
1				ALCO # G13-8	BUTTON GUARD, PLAIN BLACK		6
				BELDEN # 8778	CABLE, 6 SHIELDED TWISTED PAIRS		5
1				ALCO # MSP-105F	SWITCH, SPDT, MOMENTARY P.B.	S3	4
1				C+K # 7201-J61-2-Q	SWITCH, DPDT, ROCKER SEE NOTE 2	S2	3
1				C+K # 5215-2-Q	SWITCH, DPDT, ROCKER, ILLUMINATED	S1	2
1				CML # 335	LAMP, T-1 3/4 MIDGET SCREW	DS1	1

PARTS LIST

QTY	USED ON	NEXT ASSY	APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005-.020

MATERIAL

FINISH

DRAWN BY	Wm. D. Fountain	DATE 3/25/78
CHECKER		
APPROVED		
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
CONTROL PENDANT WIRING DIAGRAM

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	C	060352	C

SCALE NONE SHEET 1 OF 1

99/374

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-8351

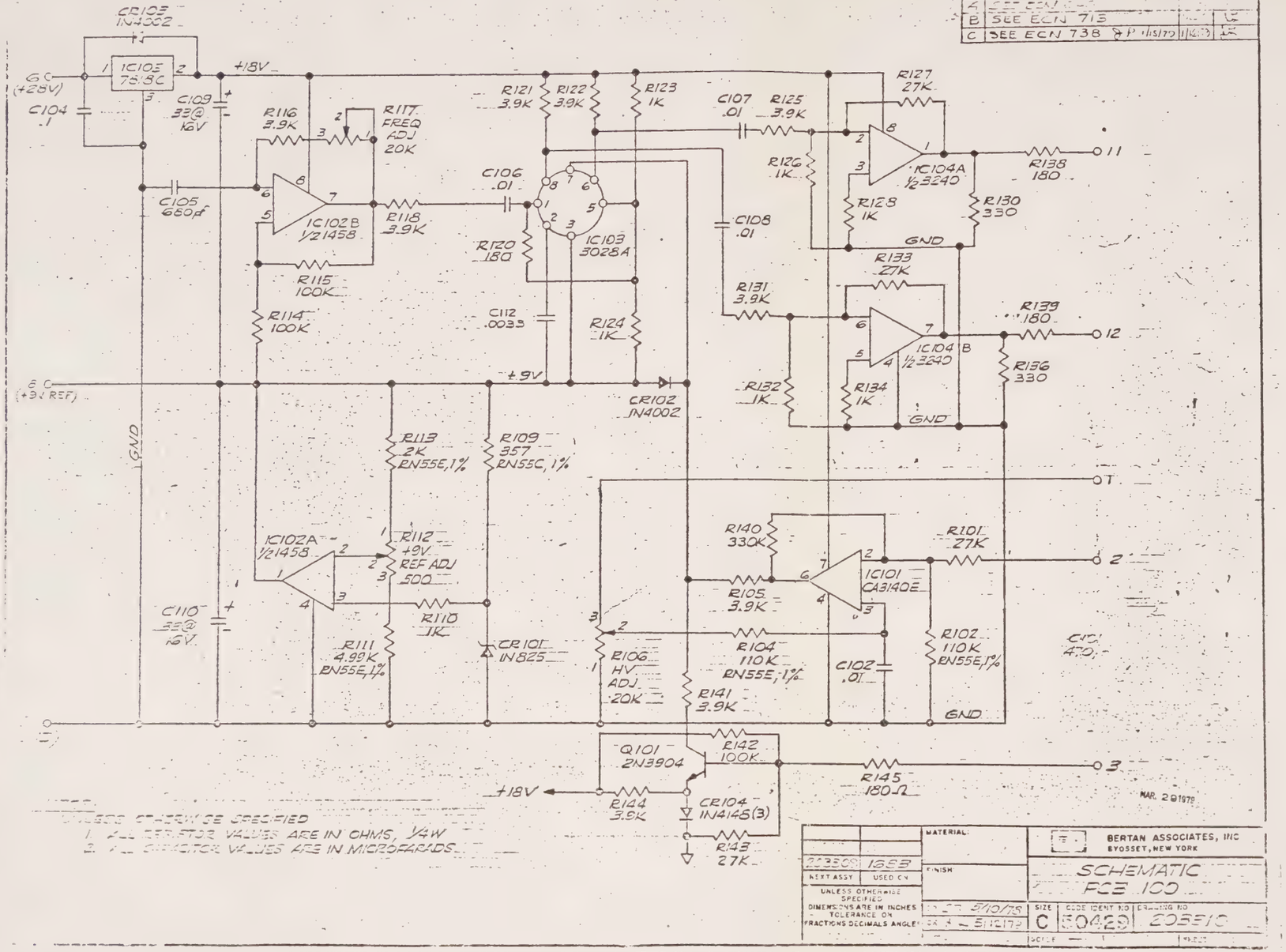
NOTES

⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	REL. ECO# 6004	4/19/79	RPC

LTR	REVISIONS	DATE	
A	SEE ECN [illegible]		
B	SEE ECN 713		
C	SEE ECN 738 RP 11/15/79	11/16/79	



UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS, ¼W
2. ALL CAPACITOR VALUES ARE IN MICROFARADS

MAR. 29 1979

223309	1853	MATERIAL:	BERTAN ASSOCIATES, INC EYOSSET, NEW YORK
NEXT ASSY	USED ON	FINISH	SCHEMATIC FCE 100
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON FRACTIONS DECIMALS ANGLE		DRAWN 5/10/78 CHECKED 5/10/79	SIZE C; CODE IDENT NO 50429; DRAWING NO 225510
			SCALE —; WEIGHT

NOTICE - PROPRIETARY INFORMATION
THE DESIGN AND RELATED INFORMATION CONTAINED HEREIN IS THE [illegible] PROPERTY OF MOLECTRON CORP. THE DISCLOSURE OF THIS INFORMATION DOES NOT CONSTITUTE THE RELEASE OF ANY PROPRIETARY RIGHTS THEREIN. PERMISSION TO REPRODUCE THIS INFORMATION OR THE PRODUCTS [illegible] CLOSED HEREIN MUST BE OBTAINED IN WRITING FROM MOLECTRON CORP.

-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

REF	QTY	APPLICATION
MY3X	USED ON	
060060	NEXT ASSY	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON –
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005–.020
MATERIAL
FINISH

DRAWN BY TMB	DATE 4/19/79	Molectron CORPORATION, 177 N. WOLFE ROAD, SUNNYVALE, CALIFORNIA 94086, (408) 738-2661
CHECKER		TITLE: BERTAN HIGH VOLTAGE POWER SUPPLY SCHEMATIC
APPROVED Gary R Canton	4/19	
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		CODE IDENT NO 34285; SIZE D; DWG NO. 060357; REV A
SIMILAR TO		SCALE; SHEET 1 OF 1

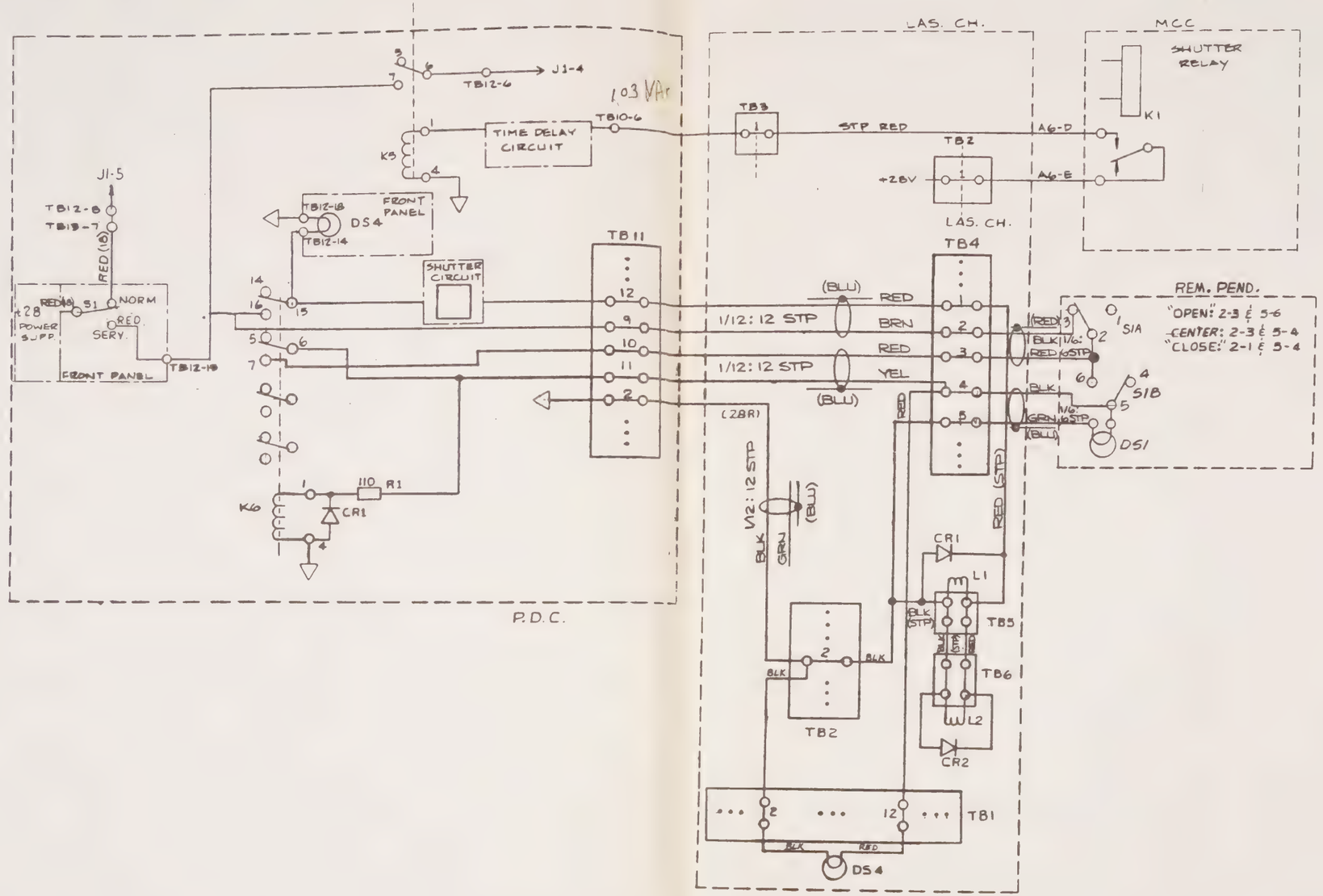
BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-835.

NOTES:

⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	REL. ECO # 2122	10/23/79	WDF
B	ECO NO 2297	2BAPR80	WDF
C	ECO# 2462	5/28/82	WDF



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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

MATERIAL				
FINISH				
NEXT ASSY	USED ON	MY3x	QTY	REF

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ——— ANG ± ———
.XXX ± ——— FIN ——— √
BREAK ALL SHARP EDGES .005 - .020

APPLICATION

DRAWN BY: BJ HUNT — DATE: 7-2-79
CHECKER
APPROVED: Wm. D. Fountain 10/1/79
APPROVED
CUSTOMER & SPEC
CONTRACT NO.
SIMILAR TO

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 736-2941

TITLE: SHUTTER CIRCUIT

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060389	C

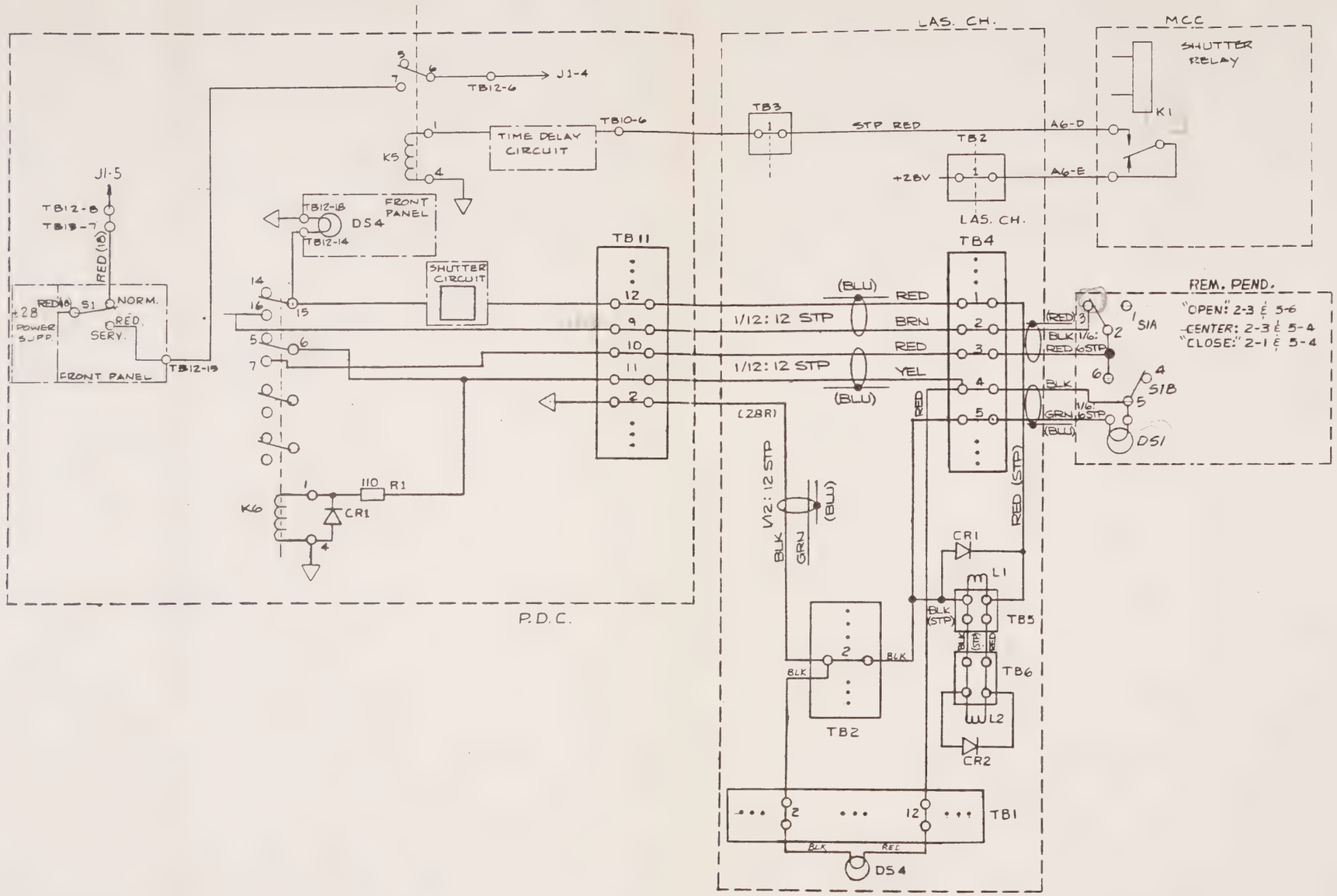
SCALE NONE — SHEET 1 OF 1

NOTES:

⚠ IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	REL. ECO # 2122	10/23/79	WDF
B	ECO NO. 2297	2BAPR82	WDF
C	ECO# 2462	5/28/82	WDF



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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

USED ON	MY3x	QTY	
NEXT ASSY		APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± —— ANG ± ——
.XXX ± —— FIN —— √
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH

DRAWN BY	BJHUNT
DATE	7-2-79
CHECKER	
APPROVED	Wm. D. Fountain (plotting)
APPROVED	
CUSTOMER & SPEC	
CONTRACT NO.	
SIMILAR TO	

Molectron CORPORATION
177 N WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
SHUTTER CIRCUIT

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060389	C

SCALE NONE SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-6257

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	REL. ECO # 2122	10-9-79	MLF
B	ECO # 2650	4/7/83	M.L.F.
C	ECO # 2813	12-6-83	MLF
D	ECO # 2962	1-11-84	MLF

⚠ COLOR CODE:
VLT: SAFETY INTERLOCK STRING
BLU: WATER FLOW SENSOR
WHT/BLU: START/STOP WATER FLOW (P27)
WHT/VLT: ENABLE/DISABLE PRIME PUMPS (P26)

4 Y CH

PWR. DIST. PWB (CHASSIS)

TO TB10-3
TO TB10-4

LAS. CH.

P1 J1 RED
BLK

D C B A
D C B A

TB2

TB11

TB6

TB1

KL COIL NOT SHOWN (CHASSIS)

FRONT PANEL

KEY SWITCH

TB1 (THERMO)

ELEC. CAB.

CHASSIS

FRONT PANEL

POWER

READY

ON

START

KEY

QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG

PARTS LIST

DRAWN BY: [illegible] DATE: 10-3-79
CHECKER
APPROVED: Mike D. Furlan 10/4/79
APPROVED
CUSTOMER & SPEC
CONTRACT NO
SIMILAR TO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DEC .XX ± —— ANG ± ——
XXX ± —— FIN —
BREAK ALL SHARP EDGES .005 - .015
MATERIAL
FINISH
NEXT ASSY
USED ON
APPLICATION
DO NOT SCALE DRAWING

Molectron
[illegible] MOLES ROAD
SUNNYVALE, CALIFORNIA
(408) 734-7401

TITLE: START/STOP CIRCUI

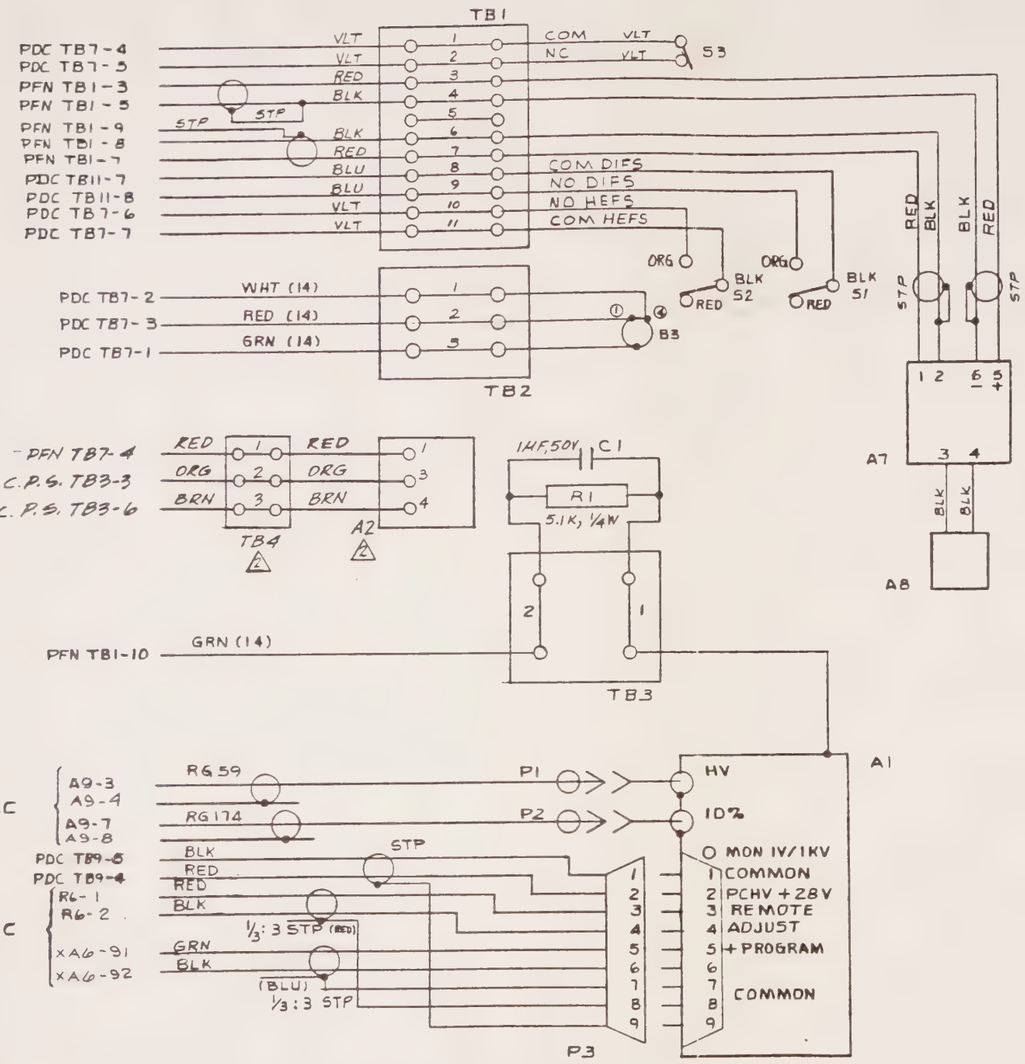
CODE IDENT NO: 34285
SIZE: E
DWG NO: 060391
SCALE: NONE
SHEET 1 OF 1

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.
2. USED ON MY33-20 AND MY34-20 ONLY.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	PROD. REL. ECO # 2122	10/23/79	WDF
B	ECO # 2166	12/6/79	WDF
C	ECO # 2190	1-18-80	WDF
D	ECO # 2230	3/7/80	WDF



REFERENCE DESIGNATORS		
FIRST	LAST	DELETED
A1	A8	A3-A6
B3	B3	–
C1	C1	–
P1	P3	–
R1	R1	–
S1	S3	–
TB1	TB4	–

		1	–	060414	SLAVE DRIVER PWA	A2	24
		1	–	2107-0245	TERMINAL BLOCK	TB4	23
		1	–	2107-0135	MARKER STRIP		22
							21
		1	1	5105-0015	FLOW SWITCH, .56PM(HEFS)	S2	20
		1	1	.5105-0010	FLOW SWITCH, 1.0 GPM(DIFS)	S1	19
							18
		1	1	4102-0005	MOTOR, AC, 60 HZ	B3	17
		1	1	2201-0030	COUNTER	A8	16
							15
							14
							13
							12
							11
							10
							9
							8
							7
							6
							5
							4
							3
							2
		1	1	060018	EVENTS COUNTER PCB	A7	1
-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

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PARTS LIST

QTY	1	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON -	DRAWN BY [signature] DATE 7-5-79
USED ON	MY3x	DEC .XX ± ANG ± .XXX ± FIN ✓ BREAK ALL SHARP EDGES .005-.020	CHECKER
NEXT ASSY	060035	MATERIAL SEE ALSO P/L OF 060035; W/L 060420; W/L 060431	APPROVED Wm. C. Fuenton 10/19/79
APPLICATION		FINISH	APPROVED
			CUSTOMER & SPEC
			CONTRACT NO.
			SIMILAR TO

Molectron CORPORATION
177 N WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
ELECTRONICS CABINET BASEPLATE WIRE DIAGRAM

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060393	D

SCALE NONE SHEET 1 OF 1

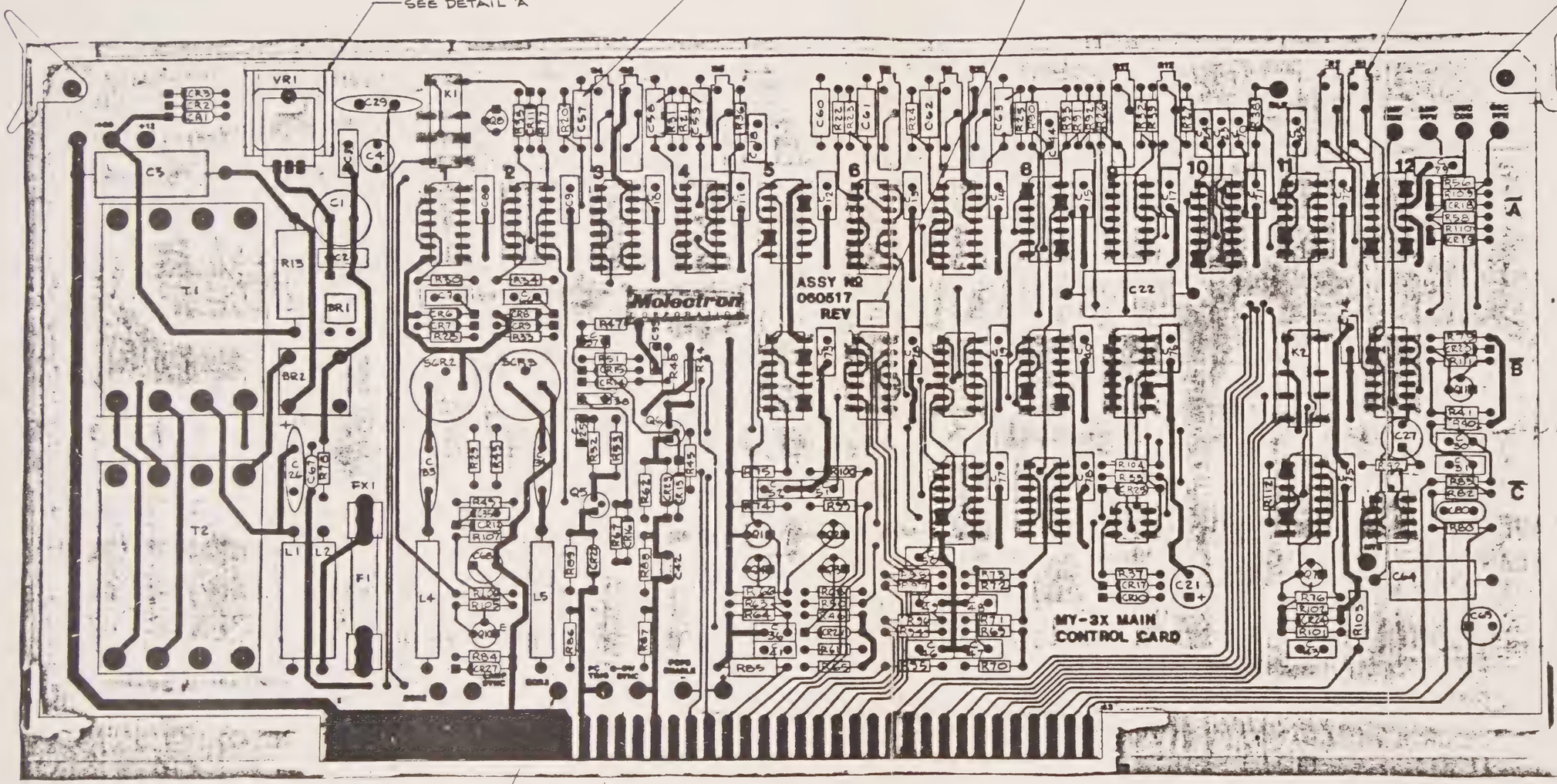
© BISHOP GRAPHICS/ACCUPRESS REORDER NO. A43BJ

DO NOT SCALE DRAWING

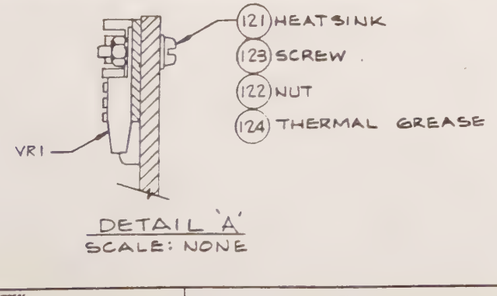
NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG
2. MARK CURRENT REV LETTER IN BOX WITH BLACK PERMANENT INK
3. MARK VALUES OF R1, R2, R4, R5, R9, R10 ON TOP WITH BLACK PERMANENT INK BEFORE ASSEMBLY.
4. POSITION C22, & C57 THRU C64, SO THAT THE VALUES ARE VISIBLE AFTER ASSEMBLY.

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	PROTOTYPE REL		
B	PROD REL ECO# 2658	5/8/81	WDF
C	ECO# 2705	6/10/81	WDF
D	ECO# 2731	6/29/81	WDF
E	ECO# 2772	8/14/81	WDF
F	ECO# 2790	9/28/81	WDF
G	ECO# 2902	3/11/82	WDF
H	ECO# 2956	4/7/82	WDF



SEE SEPARATE B SIZE PARTS LIST



DETAIL 'A'
SCALE: NONE

-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

			QTY
		A1V 3X	USED ON
		060537	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN √
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH

DRAWN BY N Gidding	DATE 2-13-81	
CHECKER		
APPROVED M. Mullen	5-18-81	
APPROVED Wm. D. Fountain	6/25/81	
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

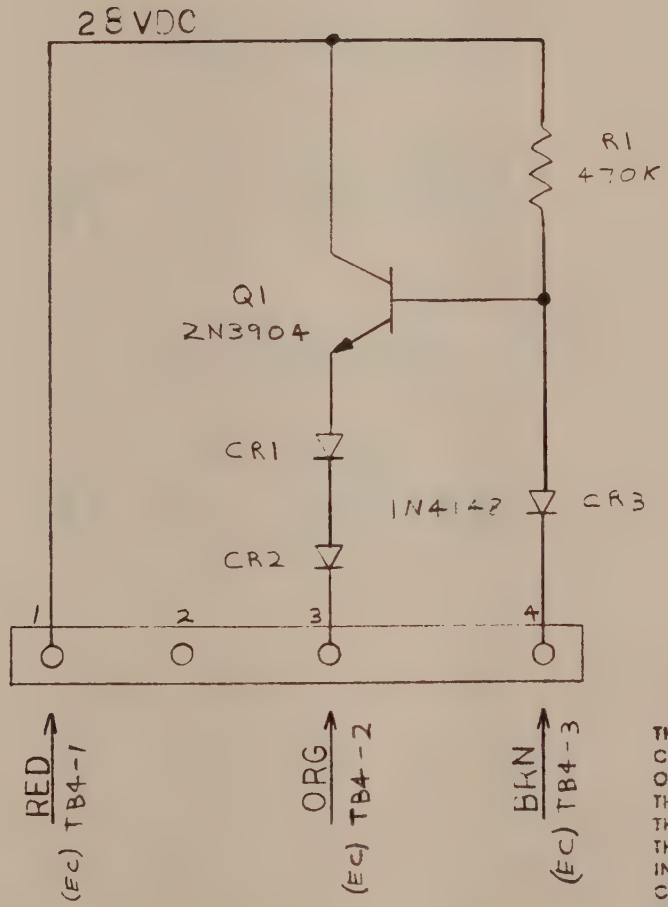
TITLE
MY-3X MAIN
CONTROL CARD ASSY

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	D	060517	H

SCALE 2:1 SHEET 1 OF 7

BISHOP GRAPHICS, ACCUPRESS MILWAUKEE WI. 44-244

REV	DATE	ECO
B	1 MAR 82	2297



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NEXT ASSY 060414
USED ON MY33/34-20

REF. 060393

SIZE	DRAWING	REV
A	060411	B

PREP. BY BD | DATE 1/80 | SHEET 1 OF 1

Molectron CORPORATION

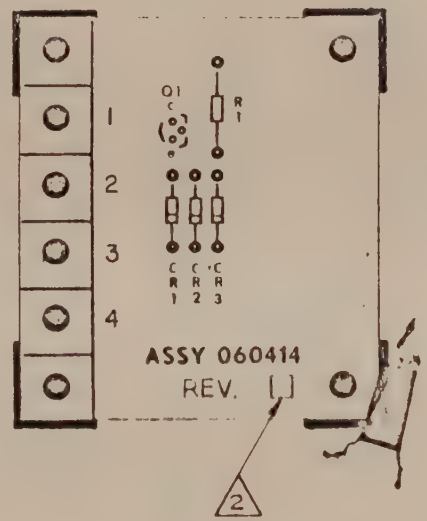
SLAVE DRIVER SCHEMATIC

NOTES

1. IDENTIFY WITH [illegible]MBER INDIVIDUALLY OR BAG AND TAG
2. STAMP LATEST REVISION LETTER IN PERMANENT INK (BLACK).

DO NOT ST[illegible]RAWING

REVISIONS			
LTR	DESCRIPTION/EC	DATE	APPROVED
A	DRAWN	2-8-80	
B	PROD REL ECO # 2297	11-4-80	WDF



QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
4 3 2 1				

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC XX ± ANG ±
XXX ± FIN ✓
BREAK ALL SHARP EDGES .005 .020

MATERIAL

FINISH

APPLICATION

NEXT ASSY

USED ON

		DATE
DRAWN BY	[illegible]	
CHECKER	[illegible]	4-17-80
APPROVED	WH	
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO		
SIMILAR TO		

Molectron
[illegible] WOLFE ROAD
SUNNYVALE CALIFORNIA 94086
(408) 738 2600

TITLE: SLAVE BOARD ASSY

CODE IDENT NO	SIZE	DWG NO	REV
34285	C	060414	B

SCALE [illegible] SHEET 1 OF 2

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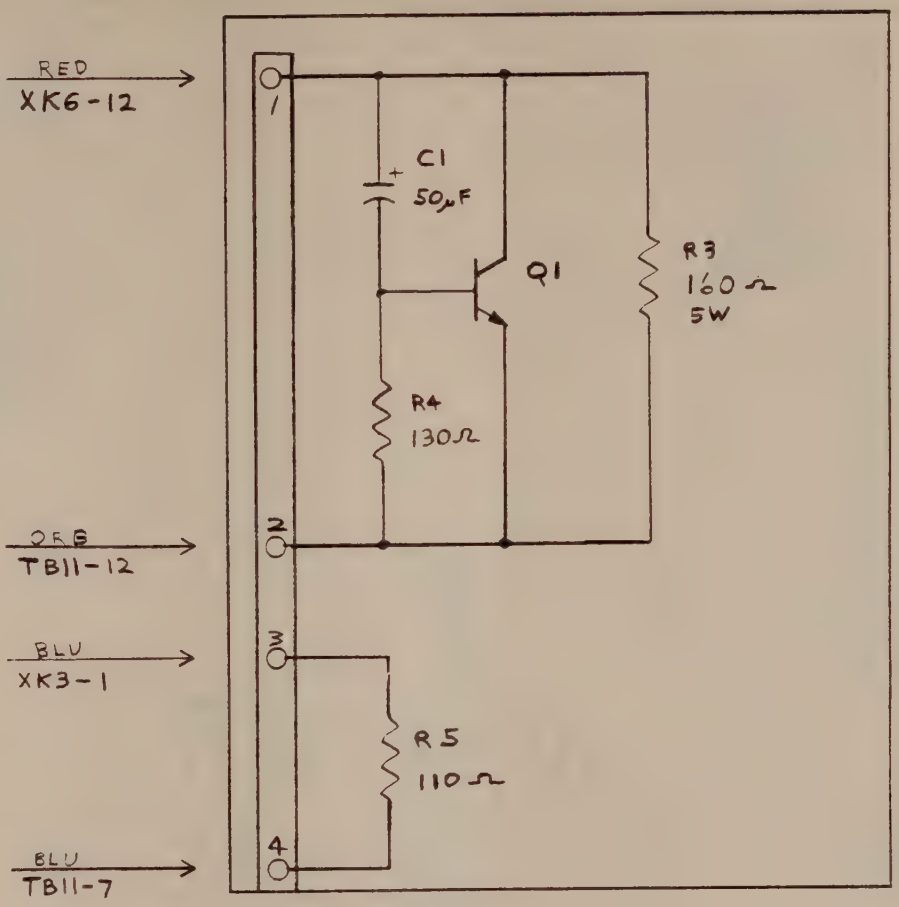
MEDINA, OHIO U.S.A.



REV	DATE	ECO
B	1 MAY 80	2297
—	—	WDF
C	6/24/80	2337 WDF/RK
E	2/12/81	2552 WDF

REV	DATE	ECO
D	9/5/80	2425
—	—	WDF

REV	DATE	ECO

REV	DATE	ECO

DELETED
R1, R2

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NEXT ASS'Y: 060426
USED ON: MY3x

SIZE	DRAWING	REV
A	060423	E

PREP. BY BD
DATE 1/80
SHEET 1 OF 1

Molectron CORPORATION

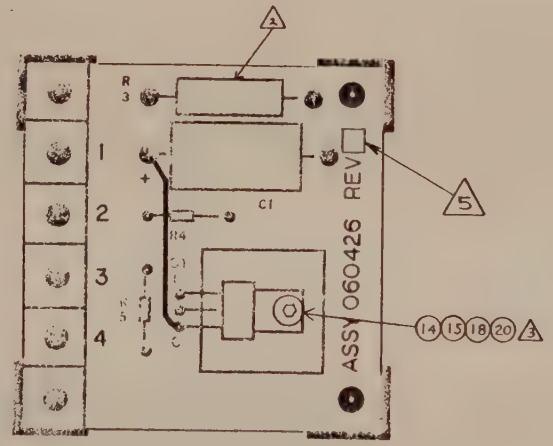
MY-3X SHUTTER BOARD SCHEMATIC

DO NOT SCALE DRAWING

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.
2. MOUNT RESISTOR ~1/8" ABOVE PC BOARD.
3. PLACE SCREW THRU TOP OF BOARD AND SECURE WITH KEP NUT ON BOTTOM.
4. REF SCHEMATIC # 060423
5. STAMP LATEST REVISION LETTER IN PERMANENT INK (BLACK).

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	DRAWN	2-8-80	—
B	PROD REL ECO # 2297	4-15-80	WDF
C	ECO# 2337	6/24/80	WDF/RWK
D	ECO# 2425	9/5/80	WDF
E	ECO # 2552	2/12/81	WDF
F	ECO # 2548	3/9/81	WDF



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-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

1	MY-3X	USED ON	QTY
060021		NEXT ASSY	APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN √
BREAK ALL SHARP EDGES .005-.020
MATERIAL
FINISH

DRAWN	Dave H	DATE 2-8-80
CHECKER	Dave H	4-17-80
APPROVED	WDF	4/18/80
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

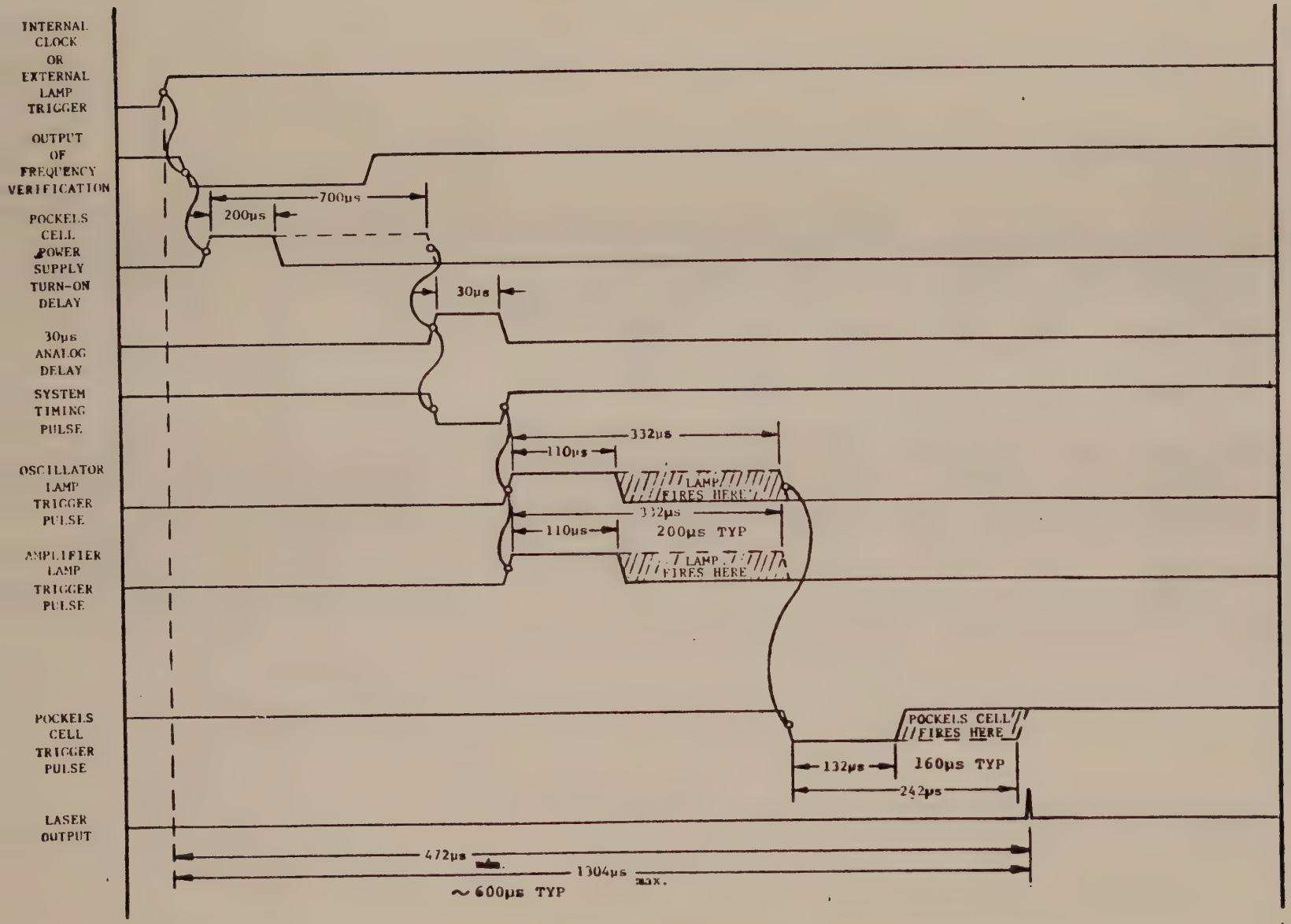
Molectron CORPORATION
177 N WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738 2661

TITLE: SHUTTER BOARD ASS'Y

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	C	060426	F

SCALE 2:1 SHEET 1 OF 2

BISHOP GRAPHICS/// CUPRESS REORDER NO. A-6351



MY3X SYSTEM TIMING

060475 A

2. ALL CAPACITORS IN μF UNLESS OTHERWISE SPECIFIED.
3. PINS 1 THRU 14 AND R THRU Y ON PC EDGE ARE TIED TO GROUND.
4. ALL OUTPUT SIGNALS SHOWN UNDER LOAD CONDITIONS.

$.709

5827

A	ECO # 2783	JMK	11-1-83
B	ECO # 2784	JMK	11-7-83
C	ECO # 2790	JMK	11-15-83
D	ECO # 2790	JMK	11-15-83
E	ECO # 3054	JMK	4-10-84

LAST REF DES.	QNT USED
BR2	
C80	
CR2	
F1	
K2	
L5	
Q11	
R111	
S1	
Z	

QUANTITY	PART NUMBER	DESCRIPTION	REF DES
PARTS LIST			

DRAWN BY: [illegible] 11/7/83
CHECKED:
APPROVED: [illegible]
RELEASED: [illegible]

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE

DEC .X ± .1 ANG ± 1°
.XX ± .03
.XXX ± .010

MATERIAL
FINISH

Molectron CORPORATION
177 E. MOSS ROAD SUNNYVALE, CALIFORNIA 94086 (408) 730-3661

TITLE
MAIN CONTROL CARD
PULSED YAG

CAGE NO.	SIZE	DWG NO.	REV
34285	E	60621	G

SCALE — SHEET 1 OF 1

REV	DATE	ECO
A		
REV	DATE	ECO
REV	DATE	ECO
REV	DATE	ECO
A	4-16-79	2004

TEST PROCEDURE - EVENTS COUNTER - PULSED YAG

EQUIPMENT NEEDED:

28 Volt Power Supply (D.C.)
Pulse Generator
Mechanical Counter
465 Oscilloscope

PROCEDURE

1. Connect the power supply to pins 5 and 6 with pin 5 positive.
2. Connect the mechanical counter to pins 3 and 4. (there is no polarity on counter)
3. Connect a pulse generator to pins 1 and 2 with pin 1 positive. Adjust the pulse generator for 50 Hz squarewave, 50% duty cycle of at least 2 volts but not more than six.
4. Turn power supply on and adjust for 28 VDC. Check the boards 12 volt power supply. It should be within ±10%.
5. The counter should be advancing at 1 count per 2 seconds. If counter is functioning properly continue at step 11.
6. Look at pin 9 of U1. There should be a 50 Hz squarewave with 12 volt voltage swings.
7. Turn power supply off and wait 20 seconds. Look at pin 7 of U2 as you turn supply back on. It should fall slowly (∿300ms) from +12 to ground.
8. Look at pin 14 of U2. There should be a negative going pulse at .5 Hz going from +12 volts to ground, approximately 400 ms wide.
9. Look at pin 5 of U1. There should be a positive going pulse approximately 12 ms wide.
10. Turn power supply off. Look at pin 4 of U1 when power is re-applied. It should rise from ground to +12 V in approximately 1 second.
11. Look at the collector of Q2. It should be normally high (at 28 VDC) with negative going pulses at .5 Hz with no spiking.
12. With pulse generator set for 200 Hz let counter run for approximately 3 minutes.
13. Initial a stick-on label and attach to board.

SIZE	DRAWING	REV
A	970271	A

PREP. BY GRC
DATE 3/79
SHEET 1 OF 1

REV	DATE	ECO
A	4.16.79	2004 thru 2500 uP
B	6/3/81	

TEST PROCEDURE - CRYSTAL OVEN HEATER CONTROLLER - PULSED YAG

EQUIPMENT NEEDED

1. 117 Vac. "cheater" cord
2. 24 Volt light bulb with clip leads
3. 10K Potentiometer with clip leads
4. VOM or scope

PROCEDURE

1. Connect cheater cord to pins 9 and 10 with pin 10 hot. Be careful when testing that these don't short.
2. Check pin 7 of U1 for +15 volts DC with respect to ground.
3. Check pin 4 of U1 for -15 volts DC with respect to ground.
4. Check pin 1 on terminal strip for +28 VDC with respect to ground.
5. Hook the 10K pot between pins 13 and 14 on the appropriate terminal strip.
6. Hook the 24 volt light to pins 1 and 4 on the appropriate terminal strip.
7. With pot set for maximum resistance the output (pin 6) of U6 should be high and the light should be on.
8. Rotate the pot towards its minimum setting. At approximately 60% of maximum the output of U6 should go low and the light should be off.
9. Move the pot to pins 12 and 15 and the light to pins 2 and 5.
10. Repeat steps 7 and 8 above for channel #2 (U2/Q2 combination).
11. Move the pot to pins 11 and 16 and the light to 3 and 6.
12. Repeat steps 7 and 8 above for channel #3 (U3/Q3) combo.
13. Initial a stick-on label and attach to board.

SIZE	DRAWING
A	970272

PREP. BY	DATE	SHEET
GRC	3/79	1 OF 1

REV
B

Molectron CORPORATION

TEST PROCEDURE - PULSED YAG
CRYSTAL OVEN HEATER CONTROLLER

REV	DATE	ECO
A	4/29/80	2275
—	—	WDF
B	5/9/80	2311
—	—	WDF
C	11/27/81	2864
—	—	WDF/KM
D	5/24/82	2995
		WDF

He-Ne Alignment of Nd:YAG Laser

INTRODUCTION: The He-Ne alignment of the Nd:YAG laser will be accomplished in a Class 100 clean facility. This procedure does not require power be supplied to the YAG laser nor does it require that the power supply be placed in the Class 100 facility.

This procedure covers the alignment of critical components in the oscillator section of the YAG laser to insure ease of adjustment in final test.

EQUIPMENT REQUIRED:

1. He-Ne Laser (1-4 mW), polarized horizontally
2. Adjustable mount for He-Ne
3. Alignment disks (980191)
4. Scatter paper (lens tissue)
5. Small ruler, divisions to 1 mm (.040"); NOTE: 1/32 = .031
6. Mounted Polaroid-type polarizer

SETUP: Place laser chassis in Class 100 facility. Place He-Ne such that the beam enters the laser chassis from the umbilical end of the laser. Prop open the oscillator shutter.

ALIGNMENT PROCEDURE:

1. Install Pockels Cell in Ass'y:

   Place Pockels cell in mount with arrow pointing inward. Insert Pockels cell until it bottoms out in clamp. Rotate so that upper Pockels cell terminal matches terminal in P.C. Driver board and other Pockels cell terminal is close to its terminal on P.C. Driver board. Tighten retaining clamp snug but not firm. Solder terminals to P.C. Driver board using vacuum to exhaust fumes and smoke. The leads to the P.C. Driver board should be stress relieved (i.e. should not be straight), but they should be short.

2. Install Pockels Cell Ass'y in Laser:

   Approximately center mount in slotted screw holes.

SIZE	DRAWING	REV
A	970292	D

PREP. BY D. DOGGETT DATE 3/80 SHEET 1 OF 4

3. Install Cavity Mirror Assemblies

Install 0060-398x Cavity Mirror Assemblies (value of x given by 060399 MY Optics Kit P/L) per detail E and sections C-C and D-D of 060520 Resonator Assy dwg. Check now and at step (14) for smooth adjustment "feel" ; if lacking, either the tip and threads of the adjusting screw(s) have not been correctly lubed with Apiezon M, or the shim washer arrangement is not correct.

4. Install Osc. Polarizer Assy:

Install 0060-3952 Polarizer Assy in osc. beam line. Set adjustment approximatly to mid-range, and lock down.

5. 1st He-Ne Alignment:

Place alignment disks in thru-holes of mirror supports. The -1 disk (with hole) should be nearest the Pockels cell mount. Send He-Ne through this hole so that it is centered on 2nd disk ± 1 mm. Remove 1st disk and direct mirror return reflections so that they center back on the He-Ne laser.

(HINT: For the flat mirror, use the 2nd reflection from the He-Ne/YAG-flat-mirror combination. With the curved mirror, use a paper with a hole in it and start near the mirror and place it farther and farther away from the mirror (nearer and nearer the He-Ne) to find the reflection; the proper reflection from the mirror will be a large, dim spot, probably with interference rings or lines in it.)

6. Disk Movement Compensation Adjustment:

If the movement of either mirror required more than 1/2 turn of either adjustment screw, replace 1st disk and readjust the He-Ne to the center of the alignment disk again, A/R. Remove 1st disk and readjust mirrors to return He-Ne reflections to He-Ne laser, A/R.

7. 1st Isogyre:

Place scatter paper in between the flat mirror and Pockels cell. Place section of white card between Pockels cell and polarizer. Place Polaroid polarizer on dust box tube and adjust it to obtain cross-and-rings pattern on card. Adjust Pockels cell, 1st by loosening Pockels cell mount hold-down screws and angulating mount, and then by using adjustment screws to place the cross centered with respect to the unscattered He-Ne beam. If cross is distorted or not present, loosen Pockels cell clamp screws intil the center of the cross is filled in.

8. 2nd He-Ne Alignment:

Reinstall 1st alignment disk and center He-Ne beam on disks such that beam is brightest going through 1st disk and is centered ± .5 mm on far disk.

9. Install λ/4 Plate Assy;

Install 0060-3961 λ/4 plate assy so reflected beam at the aperture location is deviated 6 mm ± 1 mm (.25" ± 1/16") and pointing away from the turning box (toward front of laser). The reflected beam should be level with the input beam ±3 mm (.125"); if it is not, reject assy for rework. Horizontal movement is by loosening mount screws and rotating mount.

10. Install Laser Head:

Place head in laser such that beam goes through head and the return reflection is approximately 25 mm at 250 mm (1" at 10") from metal laser head and pointing away from dorsal fin. At this point again re-adjust He-Ne so beam has maximum brightness and is centered in the far disk ±.5 mm.

11. Centering and Alignment of Laser Head:

Loosen screws of white upper pad. Using scatter paper slide head so that He-Ne beam is centered in overflash (± .5 mm in horizontal plane). Tighten upper screws and loosen lower screws on black (or green) pad and rotate head until return reflection is 25 mm ± 1 mm at 250 mm (1" ± .05 at 10") away from metal head and pointing away from dorsal fin. Repeat A/R to meet both conditions. Remove 1st alignment disk.

12. Adjust Pockels Cell:

Center Pockels cell in overflash ± .5 mm using scatter paper placed as far from Pockels cell as practical (greater than .5 meter (18 inches) is ok). Then readjust isogyre to center the cross on the unscattered He-Ne beam. If necessary, readjust centering and isogyre until both conditions are met simultaneously.

13. 3rd He-Ne Alignment:

Re-align the He-Ne through the center of the disks so that the beam has maximum brightness and is centered in the far disk ± .5 mm.

14. Final Mirror Alignment:

Check that retroreflection from flat mirror is centered on the He-Ne (if it isn't, make it so). Adjust retroreflection from curved mirror to be centered on He-Ne. Check smoothness of "feel" of the 4 adjustments (pitch and yaw for each mount); if lacking, redo step (3) A/R.

15. Final Checks

Redo measurement sections of steps (11) thru (14). If any measurement is off more than the specified amount: re-align He-Ne through the center of the disks so that the beam has maximum brightness and is centered in the far disk ± .5 mm, then return to step (11) and proceed.

16. Install Aperture Assy

Install the aperture assy. Center the aperture on the He-Ne beam.

17. Preset Waveplate

Place a white card between the polarizer and the dorsal fin. Identify the retroreflection spots (probably two) coming from the curved mirror. Rotate the $\lambda/4$ plate about its axis to maximize the brightness of these spots.

18. Button-Up

Install all osc.-line beam tubes, centered on the He-Ne beam, after checking them for burrs. (If you find burrs, remove them outside the clean facility while you're not wearing your "bunny suit", and reclean the tubes.)

19. Replace protective plastic over laser and remove from clean facility.

REV	DATE	ECO
A	3/31/81	2556 WDF
-	-	

BANDWIDTH MEASUREMENT WITH THE DL230

PURPOSE

This procedure describes the use of the monitor telescope & etalons for extracavity measurement of visible laser bandwidth. It includes techniques for obtaining quick estimates as well as techniques for accurate measurement.

EQUIPMENT REQ'D

1) DL230 Monitor Telescope

2) One of the following (see Setup):

DL231B	Monitor Etalon	(400-710 nm; .455 cm^{-1} nom. FSR);	a-s
DL231A	" "	(360-500 nm; .45 " " ");	sol
DL231C	" "	(450-750 nm; " " " ");	sol
DL226A	Intracavity "	(360-450 nm; 1.00 " " ");	a-s
DL226B	" "	(440-570 nm; " " " ");	a-s
DL226C	" "	(550-730 nm; " " " ");	a-s
DL026A	" "	(360-500 nm; 1.1 " " ");	sol
DL026C	" "	(450-750 nm; " " " ");	sol

3) Nonfluorescent Diffuse White Target (a 3" X 5" file card often is fine).

4) As required, antilaser goggles or other means of attenuating to a safe level the light leaving the target & the DL230 eyepiece.

SETUP

Direct the visible laser light (or suitable fraction thereof) onto the target. Install the etalon in the telescope & aim the telescope generally toward the spot of light. While looking thru the telescope eyepiece, adjust the aiming of the telescope as req'd to obtain the brightest & most uniform pattern of concentric circles (see Fig. 1). If the bright circles are wider than about half the width of the dark circles, consider using an etalon with a larger FSR (free spectral range); if the bright circles are narrower than about a ninth the width of the dark circles, consider using an etalon with a smaller FSR.

Adjust the DL230's reticle (thumbscrew near the eyepiece) & etalon tilter (knurled band near the etalon) so that the cross is accurately concentric with the circles. (If you need only a reasonable estimate rather than high accuracy, it is sufficient to center the reticle vertically only.) Preferably, photograph the pattern.

SIZE	DRAWING
A	970301

PREP. BY W. Fountain DATE 2/3/81

SHEET 1 OF 5

MEASUREMENT

Refer to Fig. 2.

For an estimate:

Measure & record Δ_+, Δ_-, & δ.

For an accurate measurement:

Measure & record R_p, R'_p, R_{p+1}, & R'_{p+1}.

In either case:

Record the laser wavelength, λ, & the etalon thickness, h (stamped in the retention spring that encircles the etalon housing); for new etalons that lack the retention spring, h = 5.0 ± 0.2 mm (DL226) or h = 11.0 ± 0.2 mm (DL231).

DATA REDUCTION

$$FSR(cm^{-1}) \cong 1/2n_\lambda h(cm)$$

where n_λ, the etalon's refractive index, may be obtained from Fig. 3 for solid etalons ($n_\lambda \approx 1.0003$ for air-spaced etalons); "old" etalons are solid, "new" are air-spaced.

For an estimate:

$$\Delta\kappa_b(cm^{-1}) \approx 4\delta FSR(cm^{-1})/(\Delta_+ + \Delta_-).$$

For an accurate value:

$$\frac{\Delta\kappa_b(cm^{-1})}{FSR(cm^{-1})} = \frac{R'^2_{p+1}}{R'^2_{p+1} - R'^2_p} - \frac{R^2_{p+1}}{R^2_{p+1} - R^2_p}$$

In either case:

$\Delta\kappa_b$ is the spectral bandsidth at the base of the distribution. IF the distribution is approximately Gaussian, it is often more useful to have the FWHM bandwidth, $\Delta\kappa$, which is given approximately by

$$\Delta\kappa \approx 0.6\Delta\kappa_b;$$

this is at least as accurate as "eyeball" estimation of the FWHM intensity points of the distribution, & truly accurate determination requires rather complex electronic or photographic techniques.

The resolving limit of the system is

$$\Delta\kappa_o = (FSR)/F,$$

where F is the etalon's finesse (F ≈ 30 for DL231; F ≈ 20 for DL226 & DL026): if the measured $\Delta\kappa$ is close to $\Delta\kappa_o$, then the actual $\Delta\kappa$ is less:

$$\Delta\kappa_a \approx \sqrt{(\Delta\kappa_m)^2 - (\Delta\kappa_o)^2}.$$

Finally, the bandwidth in nm may be obtained from that in cm^{-1} according to

$$\Delta\lambda = 10^{-7} \lambda^2 \Delta\kappa,$$

where λ is in nm.

Fig. 1. Sketch of View Thru DL230 Eyepiece.

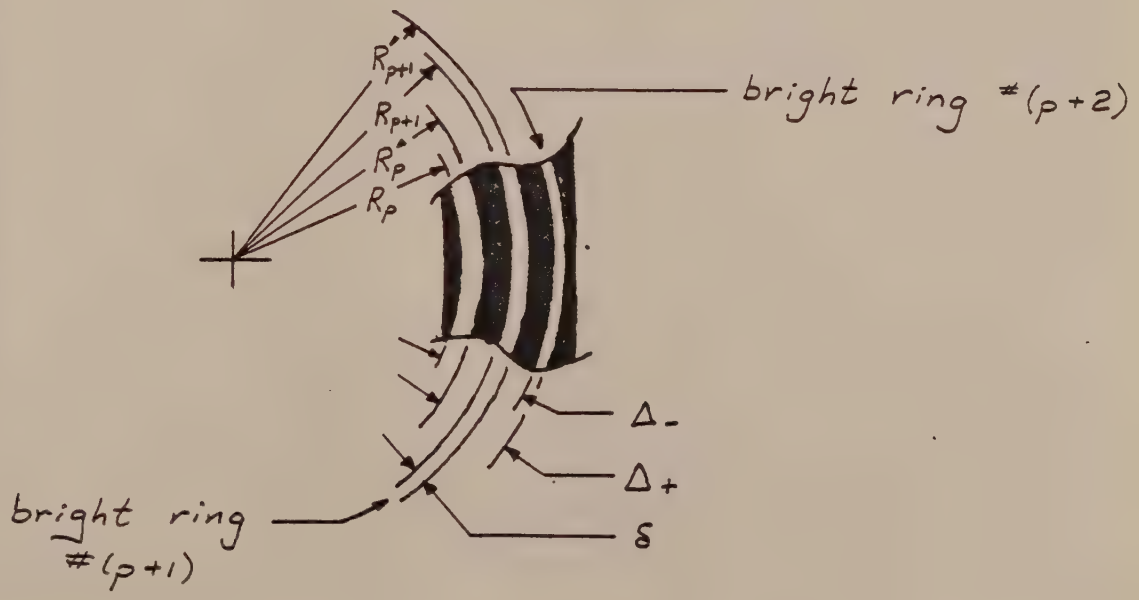


Fig. 2. Measurement Definitions ($p \geq 1$).

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A	970301	A			

Molectron CORPORATION

BANDWIDTH MEASUREMENT (DL230)

λ	n
532 nm	1.4607
580 nm	1.4587

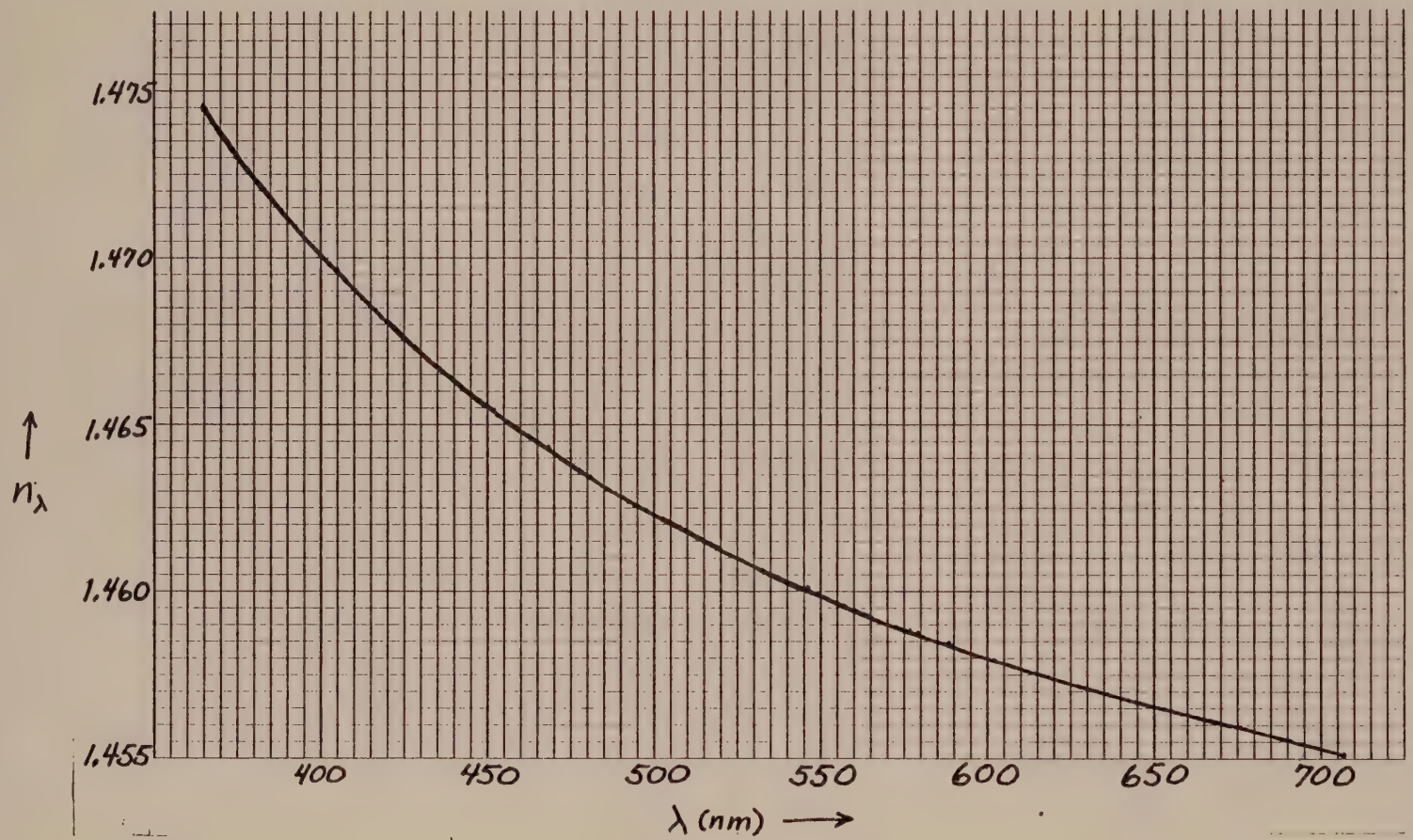

Fig. 3. Refractive Index for Solid Fused-Silica Etalons

REV	DATE	ECO
A	8MAY82	2284
-	-	WDF

MY3x PULSE DURATION ADJUSTMENT

PURPOSE

The MY Series Nd:YAG lasers are aligned, tested, and shipped with the output coupling set to optimum for full energy output; this results in a nominal output pulse duration of 15 ns (FWHM of the pulse envelope). It is possible to change this duration by changing the coupling away from optimum (by changing the $\lambda/4$-plate's setting): more coupling than optimal reduces the system gain and hence lengthens the duration; less coupling than optimal increases the system gain and hence shortens the duration (but also increases intracavity power density - this risks optics damage - and reduces the "holdoff" energy - this decreases stability). This procedure is intended to allow safe lengthening of the duration. Note well that the output energy will always decrease when the coupling is changed from optimum, and that this will be especially true for the harmonics when the duration is lengthened.

EQUIPMENT REQ'D

1) Fast Oscilloscope (e.g. Tektronix 7904 Main Frame + 7A19 Amplifier + 7B92A Dual Time Base, or equivalent; especially recommended are the Tektronix 7104/(7A19 or 7A29)/(7B10 + 7B15) combination or the Tektronix 7834/7A19/7B92A combination or a Tektronix 7912-based system with Display Monitor, because with them you can easily see the trace).

2) Fast Photodiode Ass'y (Fig. 1 shows a suggested circuit; photodiodes from Hewlett-Packard's 5082-42xx family are suitable, especially the 5082-4205).

3) Antilaser goggles or spectacles for 1064 nm(and any harmonics the system has).

SETUP

Move the beam dump, if present, to the green output port.

> DANGER
>
> At this point all personnel should don the correct protective eyewear!

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A	970305	A

PREP. BY W. Fountain DATE 4/1/80 SHEET OF 4

With the amplifier charging power supply OFF (MY 34/35 only), get the laser lasing just above threshold in the long-pulse mode. Direct the IR beam (or a convenient fraction thereof) onto a mat-finish surface of a material that: is reasonably reflective at the wavelength(s) of interest; does not fluoresce under irradiation by any of the wavelengths present; and is not damaged by the beam impacting it. Molectron recommends the use of a length of bead-blasted aluminum angle stock. Set the Q-switch mode to INT. and increase the input energy to the full-output setting; thoroughly detune the SHG ass'y, if present.

Electrically connect and activate the detection apparatus. Recommendation: use the Q-SWITCH SYNC output for the main trigger, and set the delayed sweep to "Runs After Delay". Starting with the detector well separated from the diffuse reflector, advance it until the desired signal is attained; make sure that no other source of detectable radiation is within the detector's field of view during this process.

PROCEDURE

1) Carefully, so as not to disturb the λ/4-plate setting, slide back the blue corrugated rubber tubing enough to expose the knurled λ/4-plate adjuster.

2) (Note: unless you have one of the especially recommended 'scopes, this step requires two people: one to adjust the laser, and the other under a dark cloth with the 'scope to observe the trace.) Record in which direction you are going to move the adjuster. Rotate the adjuster slightly in that direction while observing the 'scope display.

3) If the pulse envelope shortens and moves to the left (the latter will not occur if you're using the "Triggerable After Delay" setting, of course), the direction recorded is the wrong way: record the correct direction. If the pulse envelope lengthens and moves to the right, the direction recorded is correct. If you can detect neither, increase the adjustment (in the recorded direction) until you can.

4) You may now freely rotate the adjuster in the correct direction, so long as the pulse envelope continues to lengthen and the output energy to decrease*. (It may be more convenient at this point to use the delayed sweep, on internal trigger, in the "Triggerable After Delay" mode.)

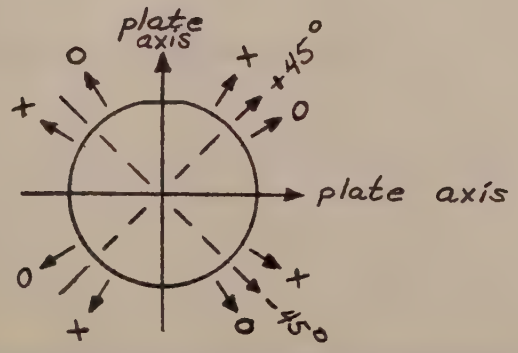
5) It is now permissible to decrease the oscillator input energy and/or to run the amplifier, as desired.

*See Appendix, p. 3.

6) To reattain optimal coupling: if the system has SHG, do step (42) of the MY Test Procedure, 970270; if no SHG, set the oscillator input to the prior setting for full output, and maximize the output energy by rotating the λ/4-plate in the opposite direction from that recorded as "correct" in step (3) above.

APPENDIX

There are eight (8) settings of the λ/4-plate that provide the same output coupling. These may be divided into two (2) inequivalent groups of four (4) settings: the two groups treat local system aberrations oppositely, and hence one group (probably) provides a better beam profile than does the other. Be careful in steps (4) and (6) above not to adjust the λ/4-plate through the energy minimum to a "wrong" setting. The settings are shown schematically by "x" and "o" on the sketch below (output coupling is ∿0 for either plate axis vertical, and optics will almost certainly be damaged; output coupling is ∿ 100% for either 45° line vertical, and laser probably will not oscillate).

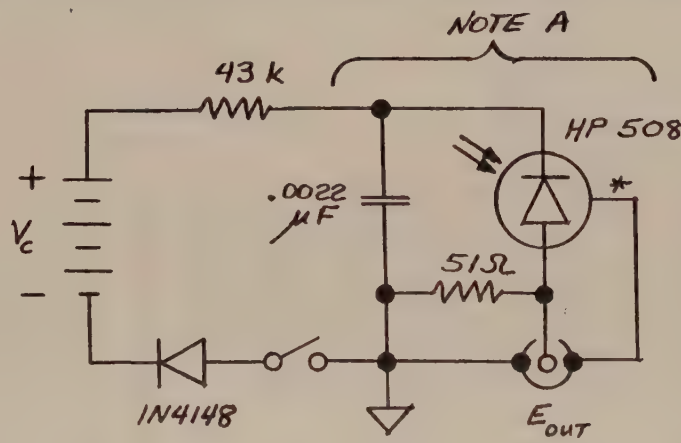


REV | DATE | ECO

SIZE A | DRAWING 970305 | PREP. BY | DATE | SHEET OF 4 | REV A

Molectron CORPORATION

MY3x PULSE DURATION ADJUSTMENT



*EXCEPT: -4205, -4220

Fig. 1. Suggested Photodiode Circuit

V_c = 15 V FOR -4204, -4207; OTHERWISE 45 V

E_{out} (50Ω LOAD) ≤ 11 V ABSOLUTE MAXIMUM PEAK
≤ 5V PEAK, PREFERRED

KEEP PEAK OPTICAL POWER < 8W @ 1064 nm;
< 1W @ 770 nm
(WORST CASE)

NOTE A: IN THIS SECTION, USE PROPER HIGH-FREQUENCY LAYOUT & CONSTRUCTION TECHNIQUES.

REV	DATE	ECO
A	5.2.80	2311
—	—	WDF
B	5-12-81	2594
—	—	WDF
C	3/5/82	2681
—	—	WDF

MY ELECTRICAL CHECKOUT PROCEDURE

INTRODUCTION

The laser system will be delivered to the electrical test station lacking the main control card and any laser heads. All wiring should be complete. The laser chassis covers will have been replaced (temporarily) by a plastic cover sheet.

This procedure covers check-out of the system's electrical functioning.

SETUP

Fold back plastic cover sheet only to extent req'd; completely install TEST OSC HEAD and Main Control Card (MY34/35: also completely install TEST AMP HEAD). Recover laser chassis.

Connect the hoses from the city water (after the filters) and connect the drain. Make sure that the hoses have washers and are not kinked or twisted. Connect the power console line cord to the proper plug (through the proper power conditioning transformer, if appropriate). Do not plug into receptacle.

1. CHECK FOR PROPER VOLTAGE, PHASING, AND FREQUENCY - With the power cord not plugged into the AC outlet, verify that the outlet's voltage, phasing (Δ or Y), and frequency (50 or 60 Hz) are correct for this system.

2. INITIAL SETUP - Set the various switches, knobs, etc., as follows:

CITY WATER: should be valved off.

POWER CONSOLE: check that all fuse holders are tight;

SERVICE/NORMAL switch: in NORMAL position

WATER circuit breaker: ON

CHARGING POWER SUPPLY circuit breakers: all OFF

INTERLOCKS: Install interlock plug in J-1 on P.D.C.

Install jumper on P-1 from A to B on laser chassis.

CONTROL PANEL: KEY SWITCH: in OFF position

REMOTE CONTROL PENDANT: Q SWITCH rocker switch: NORMAL position

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ECO	DESCRIPTION
	CLOSED WITH ECO

PREP BY DED & WDF | DATE 5/5/82 | SIZE A | DRAWING NO. 970308 | REV C | SHEET 1 OF 8

SERVICE SUBPANEL:

OSCILLATOR/AMPLIFIER switch: in OSC position

OSCILLATOR and AMPLIFIER potentiometer knobs: both fully counterclockwise (CCW; these potentiometers have clutches rather than stops, so the end-of-travel indication is an increase in the torque required to turn the knob).

PULSE RATE switch: FIXED 10/20 position

Q-SWITCH rotary switch: LONG position

VOLTAGE ADJUST pot: Full CW

Rear of PFN CHASSIS: Toggle switches S2 & S3 OFF

POCKELS CELL H.V.P.S.: Disconnect Molex Connector

PROCEDURE

3. INITIAL TEST FOR CORRECTNESS OF WIRING

Plug the power cord into the AC outlet. At this point, nothing in the power console or laser chassis should be active; if something is active, debug the system. Otherwise, insert the key into the KEY SWITCH and turn it to the ON position (¼ turn CW). The POWER lamps on the power console and control panel should now be illuminated and fans hould be ON. Wait for a minute or so and look for smoke!

4. INTERLOCK CHECK

Defeat the electrical interlocks (toward the rear of the laser chassis, on the cover support bar) by pulling up their plungers; the READY lamp on the control panel should now be illuminated. (if not, check for defeat of the PFN chassis electrical interlock.)

5. CHECKOUT OF SHUTTER CIRCUIT

Put the SERVICE/NORMAL switch in SERVICE position; the control panel lamps should go out. Rock the SHUTTER switch to OPEN position: both shutters should open, and the SHUTTER switch lamp and the SHUTTER OPEN lamps on the laser chassis and on the power console should light up. Rock the SHUTTER switch to CLOSE: both shutters should close, and the 3 shutter-related lamps should go out. Open the shutters, turn off the KEY SWITCH; the shutters will close after awhile (they should not close immediately):

if they close at different times, the one that closes earlier should be the oscillator shutter; exchange solenoids if necessary and redo this step until this is satisfied. Put the SERVICE/NORMAL switch back in NORMAL position and turn the KEY SWITCH back on.

6. WATER SYSTEM CHECKOUT

Depress and hold the START button; this will start the water pump in the power console; check for water leaks; continue to hold this button depressed until all large bubbles have been purged from the system (as observed at the laser head tubing), then release; the pump should turn off. Add distilled or organic-free deionized water as required to fill the coolant reservoir 1/2 - 2/3 full. Allow a minute or so for small bubbles to coalesce, then repeat this step. Continue this process until no large bubbles appear.

7. CHECK WATER LIGHT

If the CITY WATER OUT line has a valve at the drain, open this valve. While watching the WATER lamp (on the power console), open the valve to the CITY WATER IN line, slightly past the point where the WATER lamp is illuminated. If it doesn't light, turn the water valve off and debug the system.

8. CHECK WATER INTERLOCK SWITCH

Depress the START button and hold it until the ON lamps are illuminated. The water pump should now stay on. (The flashlamps should still be off.)

9. SHUTTER TIME DELAY CHECK

Hold the SHUTTER rocker switch in the OPEN position until the shutters open and the SHUTTER switch and the SHUTTER OPEN lamps are illuminated; the delay from the time the ON lamps are illuminated should be roughly 10 seconds.

10. COMPLETE LASER SHUTDOWN

Depress the STOP pushbutton and hold it until the ON lamps go out; this should also turn the pump motor off.

DANGER!

To avoid shock, DO NOT TOUCH LASER HEAD

WHEN ITS SIMMER SUPPLY IS ENERGIZED!

11. SIMMER CHECKOUT

Switch ON PFN Chassis toggle switch S2 only. Restart the laser. Look through the oscillator's rear mirror into the rod: if there is a white glow, the simmer supply is working. If absent or unstable, debug simmer circuit. Shut laser down completely and unplug, turn off city water, short H.V. capacitors. For amplifier, repeat step, except use switch S3.

12. SET THE STORED ENERGY IN CAPACITOR AND ADJUST JOULEMETER

A. MY32/34 Only:

Set a digital voltmeter (DVM) across R7 in the PFN chassis. Note the value of C1 in μF that was hand-written by Molectron Q.A. (not the vendor-printed value!). Calculate V1 = $29.97/\sqrt{C1(\mu F)}$; V1 should be close to 5.356 volts since C1 should be close to 31.3 μF. At the laser chassis set the PULSE RATE switch to EXT. Turn on water and restart laser. At the power console, turn on the oscillator charging power supply circuit breaker only, and verify that the FULL CHARGE lamp (on the rear of the supply) comes on within about 3 sec. At the laser chassis, adjust the OSCILLATOR pot (R2) until the DVM reading is V1. Return the PULSE RATE switch to FIXED 10/20 and verify that the oscillator lamps flash at about 10 Hz or 20 Hz. Check that events counter display is advancing one count every 100 shots (about 10 sec. or 5 sec.). Adjust potentiometer R1 on the master control card, if necessary, to obtain a service subpanel meter reading of 39. Shut down laser completely and unplug, turn off city water, short high voltage capacitor.

B. MY33/35-10 Only:

Set a digital voltmeter (DVM) across R7 in the PFN Chassis. Note the value of C1 (= C1a + C1b) in μF that was handwritten by Molectron Q.A. (not the vendor-printed value!) Calculate V1 = $56.04/\sqrt{C1(\mu F)}$; V1 should be close to 6.379 volts since C1 should be close to 77.2 μF. At the laser chassis set the PULSE RATE switch to EXT. Turn on water and restart laser. At the power console, turn on the oscillator charging power supply circuit breaker only, and verify that the FULL CHARGE lamp (on the rear of the supply) comes on within about 3 sec. At the laser chassis, adjust the OSCILLATOR pot (R2) until the DVM reading is V1. Return the PULSE RATE switch to FIXED 10/20 and verify that the oscillator lamps flash at about 10 Hz or 20 Hz. Check that events counter display advances one count every 100 shots (about 10 sec. or 5 sec.).

Adjust potentiometer R1 on the master control card, if necessary, to obtain a service subpanel meter reading of 61. Shut down laser completely and unplug, turn off city water, short high voltage capacitor.

13. SET STORED ENERGY LIMIT

Without disturbing the setting, remove one of the leads to the OSCILLATOR pot (R2) and accurately measure the resistance of R2; R7 of the laser chassis will be the closest value of stock resistor (preferably 1%) to this resistance reading. Install R7, being careful to suck the rosin "smoke" away from the laser.

Restart the laser. Verify that the meter reading is $\lesssim$ 12 (MY32/34) or $\lesssim$ 25 (MY33/35) with the OSCILLATOR pot (R2) fully CCW, and is close to 39 (MY32/34) or 61 (MY33/35) with R2 fully CW; leave R2 fully CW.

14. ADJUST QUENCH DELAY

Set the PULSE RATE switch to VARIABLE and set the VARIBLE pot fully CW (to HI). Increase the Quench Delay adjustment as necessary to produce a reading of 19 (MY32/34) or 31 (MY33/35) on the joulemeter. Return the OSCILLATOR pot to its full CCW position, and turn off the laser completely (as per step 12).

NOTE: STEPS 15-17 APPLY ONLY TO MY34/35-10.

15. In the PFN chassis, set a digital voltmeter (DVM) across R8. Note the value of C2 (= C2a + C2b) in μF: use the values handwritten on C2a and C2b by Molectron Q.A. (not the vendor-printed values!). Calculate $V2 = 64.18/\sqrt{C2(\mu F)}$; V2 should be close to 7.305 V since C2 should be close to 77.2 μF. At the laser chassis, set the PULSE RATE switch to EXT and restart the laser (after turning on the city water). At the power console, turn on the amplifier charging power supply circuit breaker only, and verify that the FULL CHARGE lamp (on the rear of the supply) comes on within about 3 sec. At the laser chassis, adjust the AMPLIFIER pot (R3) until the DVM reading is V2. Return the PULSE RATE switch to FIXED 10/20 and verify that the amplifier lamps flash at about 10 Hz or 20 Hz. Adjust potentiometer R2 on the master control card, if necessary, to obtain a service subpanel meter reading of 80 (with the OSCILLATOR/AMPLIFIER switch in AMPLIFIER position). Turn off the laser completely.

16. Without disturbing the setting, remove one of the leads to the AMPLIFIER pot (R3) and accurately measure the resistance of R3; R8 will be the closest value of stock resistor (preferably 1%) to this resistance reading. Install R8, being careful to suck the rosin "smoke" away from the laser.

17. Restart the laser. Verify that the meter reading is $\lesssim$ 25 with the AMPLIFIER pot (R3) fully CCW, and is close to 80 with R3 fully CW; leave R3 fully CCW.

NOTE: STEPS 18-22 APPLY ONLY TO MY34-20.

18. In the PFN chassis, set a digital voltmeter (DVM) across R8. Note the value of C2 (= C2a + C2b) in μF: use the values handwritten on C2a and C2b by Molectron Q.A. (not the vendor-printed values!). Calculate $V2 = 64.18/\sqrt{C2(\mu F)}$; V2 should be close to 7.305 V since C2 should be close to 77.2 μF.

> DANGER!
>
> CHECK to see that: in PFN chassis, red wire from J3-A should NOT be connected to C2-HOT (W/L 060439, W-111); black wire from Slave C.P.S. TB3-4 snould NOT be connected to Master C.P.S. TB3-5 (W/L 060431, W-88); at Slave C.P.S. P1 should NOT be mated to J1 (W/L 060431, W-95 and W-96); Circuit Breaker Tie Bar 0060-4320 should be attached ONLY to the circuit breaker of the Slave C.P.S.
>
> FAILURE TO OBSERVE THESE PRECAUTIONS MAY LEAD TO FATAL ELECTRICAL SHOCK!

Temporarily attach a 50 kΩ pot between TB3-8 and TB3-9 of the Slave C.P.S.; temporarily disconnect P1 of the Master C.P.S. and mate it to J1 of the Slave C.P.S. At the laser chassis, set the PULSE RATE switch to EXT and restart the laser (after turning on the city water). At the power console, turn on the Slave charging power supply circuit breaker only, and verify that the FULL CHARGE lamp (on the rear of the supply) comes on within about 3 sec. Adjust the temporary pot until the DVM reading is V2. Turn off the laser completely (including all c.p.s. circuit breakers).

19. Without disturbing the setting, remove the temporary pot and accurately measure its resistance. Select the closest lower value of stock resistor (preferably 1%) to this resistance reading. Using 2190-0130 solder lugs, install this fixed resistor where the temporary pot was (i.e. between TB3-8 and TB3-9 of the Slave C.P.S.), being careful to suck the rosin "smoke" away from the laser.

20. Restore P1 of the Master C.P.S. to its correct state. At the laser chassis, set the PULSE RATE switch to EXT and restart the laser (after turning on the city water). At the power console, turn on the master amplifier charging power supply circuit breaker only, and verify that the FULL CHARGE lamp (on the rear of the supply) comes on within about 3 sec. At the laser chassis, adjust the AMPLIFIER pot (R3) until the DVM reading is V2. Turn off the laser completely (including all c.p.s. circuit breakers).

21. Without disturbing the setting, remove one of the leads to the AMPLIFIER pot (R3) and accurately measure the resistance of R3; R8 will be the closest value of stock resistor (preferably 1%) to this resistance reading. Install R8, being careful to suck the rosin "smoke" away from the laser.

22. Attach the Circuit Breaker Tie Bar (0060-4320) between the circuit breakers of the Master and Slave charging power supplies; at Slave C.P.S., mate P1 to J1; connect black wire from Slave C.P.S. TB3-4 to Master C.P.S. TB3-5.

> DANGER!
>
> USE SHORTING STICK TO DISCHARGE ALL H.V. CAPACITORS!

In PFN Chassis, connect red wire from J3-A to C2-HOT. At the laser chassis, set the PULSE RATE switch to EXT and restart the laser (after turning on the city water). At the power console, turn on the amplifier charging power supply circuit breaker pair only, and verify that the FULL CHARGE lamp on the rear of the master supply comes on within about 3 sec. (the slave supply's lamp may be ignored). At the laser chassis, adjust the AMPLIFIER pot (R3) until the DVM reading is V2 (or as close as you can get to V2). Return the PULSE RATE switch to FIXED 10/20 and verify that the amplifier lamps flash at about 20 Hz. Adjust potentiometer R2 on the master control card, if necessary, to obtain a service subpanel meter reading of 80 (with the OSCILLATOR/AMPLIFIER switch in AMPLIFIER position). Verify that the meter reading is $\lesssim$ 25 with the AMPLIFIER pot (R3) fully CCW, and is close to 80 with R3 fully CW; the master FULL CHARGE lamp should come on after every shot over the whole range, but the slave FULL CHARGE lamp should come on only for meter readings $\geq$ 80 (if then); leave R3 fully CCW.

If, after the amp. lamps have flashed at least once, the lamps contine to glow, and the amp charging power supplies whine and won't charge up, then the amplifier QUENCH DELAY settings are too short. Turn off the (paired) amp. c.p.s. circuit breakers; increase each amp. QUENCH DELAY the same amount (say, 1-2 turns); turn the supplies back on and see if the amount of your adjustment was sufficient; repeat A/R.

23. RATE

Check FIXED 10/20 rep rate: If not 10 Hz or 20 Hz within experimental error, reject card — DO NOT ADJUST. Switch PULSE RATE to VARIABLE and turn rate pot fully CCW. The rep rate should be approximately 5 Hz or 10 Hz. If shutter closes and lamps stop, adjust R11 on master control card.

24. INTERNAL/EXTERNAL FUNCTIONS

Run terminated 50-Ω cable from LAMP SYNC to 'scope. There should be an 8-V positive-going pulse with $t_r \approx 100$ ns and an exponential decay ($\tau \approx 100$ µs) synchronized with lamps. Move cable to Q-SWITCH SYNC. Place Q-SWITCH mode in INT. There should be an 8-V positive-going pulse with $t_r \approx 3$ ns and an exponential decay ($\tau \approx 20$ ns). Switch Q-SWITCH mode to EXT. Run another BNC cable from an external 10-Hz, +6-V pulse source into Q-SWITCH TRIGGER. Check that Q-SWITCH SYNC out is now synchronized with external source. Place Q-SWITCH mode in INT. Switch control pendant to SINGLE SHOT. Press button; Q-SWITCH SYNC out should pulse once and only once after each firing. Return control pendant to NORMAL. Move BNC from Q-SWITCH TRIGGER to LAMP TRIGGER. Place PULSE RATE switch in EXT. Lamps should now be flashing at the external rate. Return PULSE RATE to INT.

25. POCKELS CELL ELECTRONICS

Turn laser off. Connect Molex connector at Pockels cell HV supply. Fold back plastic cover sheet as necessary (only). Remove Faraday cage from Pockels cell driver ass'y. Connect 1000x HV 'scope probe (Tektronix P6013A or P6015, or equiv.) to E5 of driver ass'y. (NOTE: PROBE MUST BE COMPENSATED FOR, & CALIBRATED WITH, THE 'SCOPE BEING USED!

DANGER! 3500 VOLTS!

Turn laser on. Set Q-SWITCH mode to INT. Open shutters. Displayed waveform should rise from 0 V to ∿ 3.6 V in ≤ 600 µs (⅝ to 100% — not 10% to 90%), be flat @ ∿ 3.6 V for several hundred µs (with the exception of a fast spike to 0 V), and then decay slowly back to 0 V (100%-to-10% fall time < 40 ms). Set control pendant to "SINGLE SHOT". Waveform should be a constant ∿ 3.6 V. Set Q-SWITCH mode to LONG: displayed waveform should be a constant 0 V. Turn laser completely off; remove probe; reinstall Faraday cage.

TAKEDOWN

Fold back plastic cover sheet as necessary (only); remove TEST laser HEADS; re-cover laser chassis (after any req'd vacuuming). Disconnect system from AC power, city water, and drain.

MODEL/REP. RATE

WAVELENGTH	MY32 -10	MY32 -20	MY33 -10	MY34 -10	MY34 -20	MY35 -10	
1064nm	250	225	500	850	770	1050	mJ
532nm	90	82	180	300	275	400	mJ
355nm	36	33	72	150	138	210	mJ
266nm	18	16.5	35	65	55	90	mJ
MY2SH							mJ
MYTH2							mJ

Addition of the MY-E will produce a drop of approximatelv 10% in the above specifications @ 1064 nm (further drop, in harmonics), oscillator-only.

Addition of the MY-SP will produce a drop of approx. 20% @ 1064 nm, oscillator-only, as for MY-E.

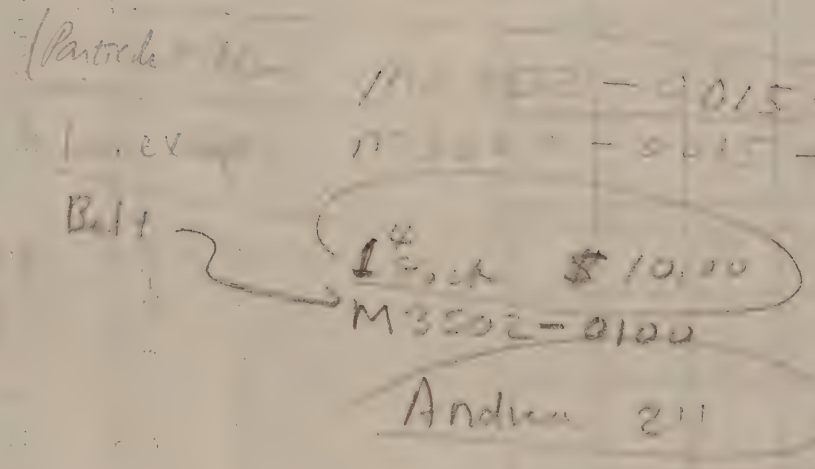
Addition of the MY-SAM will produce a drop of approx. 60% @ 1064 nm, oscillator-only, as for MY-E.

REV	DATE	ECO
A	12/4/87	2818
—	—	WBF

SIZE: A
DRAWING: 9703329
PREP. BY: M. FREEMAN
DATE: 12/30
SHEET 1 OF 1
REV: A

Molectron CORPORATION

MY3X INHOUSE ENERGY SPECIFICATIONS

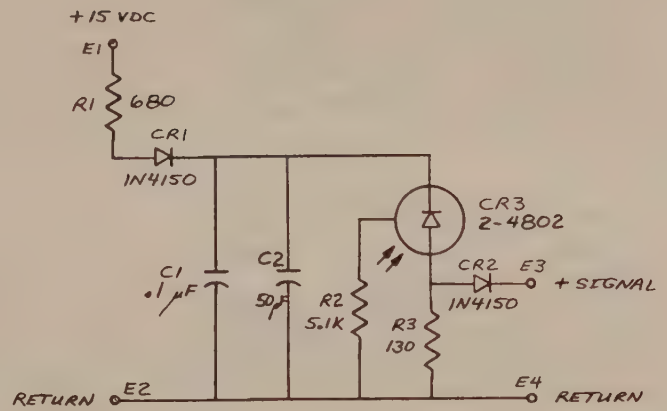

Bill
1 Each $10.00
M3502-0100
Andrew 21

NOTES:

1. IDENTIFY WITH PART NUMBER INDIVIDUALLY OR BAG AND TAG.

DO NOT SCALE DRAWING

REVISIONS			
LTR	DESCRIPTION/ECO	DATE	APPROVED
A	PREPROD REL ECO# 2652	5/6/81	WDF
B	PROD. REL ECO# 2767	8/4/81	WDF



-4	-3	-2	-1	QUANTITY	PART NUMBER	DESCRIPTION	REF DESIG	ITEM

PARTS LIST

REF	QTY
MY-SAM	USED ON
060534	NEXT ASSY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ANG ±
.XXX ± FIN ✓
BREAK ALL SHARP EDGES .005-.020

MATERIAL

FINISH

		DATE
DRAWN BY	Wm. D. Fountain	4/6/81
CHECKER	B. Woodward	8/4/81
APPROVED		
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO.		
SIMILAR TO		

Molectron CORPORATION
177 N. WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738-2661

TITLE
SAM P.D. SCHEMATIC

CODE IDENT NO.	SIZE	DWG NO.	REV
34285	B	060531	B

SCALE — SHEET / OF - /

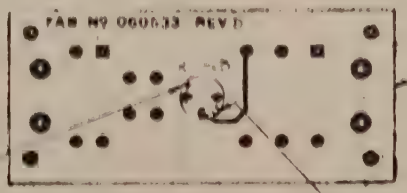
BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-8349

NOTES:

1. IDENTIFY WITH [illegible] NUMBER INDIVIDUALLY OR BAG AND TA[illegible]
2. QA NOTE: PHOTODIODE TAB IS ORIENTED 180° FROM TRANSISTOR TAB, SO ORIENTATION DOT ON SOCKET DOES NOT LINE UP WITH TAB; PHOTODIODE TO BE INSERTED SO THAT PHOTODIODE LEADS NATURALLY LINE UP WITH SOCKET HOLES.

DO NOT SC[illegible] RAWING

LTR	DESCRIPTION/ECO[illegible]	DATE	APPROVED
A	PR PROD REL ECO# [illegible]	5/6/81	WLF
B	[illegible]	6/81	[illegible]
C	PROD. REL. ECO# 2767	8/4/81	WLF
D	ECO# 2838	11/5/81	WLF



SHOWN FOR COMPONENT PLACEMENT ONLY.

INDICATOR DOT (IF ANY) ON SOCKET

TAB OF PHOTODIODE

SEE SEPARATE B SIZE PARTS LIST

-4	-3	-2	-1	PART NUMBER	DESCRIPTION	REF DESIG	ITEM
QUANTITY							

PARTS LIST

		-			
		MT-SAM	USED ON	DWG	
		060535	NEXT ASSY		

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON -
DEC .XX ± ~ ANG ± °
XXX ± ~ FIN ✓
BREAK ALL SHARP EDGES .005 - .020

MATERIAL

FINISH

DRAWN BY	[illegible]	DATE 2 2 8
CHECKER		
APPROVED	[illegible]	[illegible]
APPROVED		
CUSTOMER & SPEC		
CONTRACT NO		
SIMILAR TO		

Molectron
177 N WOLFE ROAD
SUNNYVALE, CALIFORNIA 94086
(408) 738 2661

TITLE

SAM P.D. ASSY

CODE IDENT NO	SIZE	DWG NO	REV
34285	C	060534	2

SCALE 2/1 SHEET 1 OF 2

© BISHOP GRAPHICS/ACCUPRESS REGISTER NO. A-0551

MY Series Nd:YAG Laser

FINAL ASS'Y AND TEST PROCEDURE

SUMMARY

Step(s)	pp.	Item/Action
-	2	Introduction
-	2,3	Equipment Req'd
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-	4	Setup
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14-19	7-9	Oscillator Self-Alignment (Long-Pulse)
20	9,10	Optimize Osc. Coupling (Long-Pulse)
21-23	11-13	Oscillator Self-Alignment (Q-Switched)
24-36	13,14	Align Osc. Polarizer; Adj. Timing & Coupling
37	14	Align 2nd Beam Line (Preliminary)
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50	18	Profile Footprints
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53	19	E_S
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55	19,20	Reset Conditions
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71	25,26	Remaining IR Measurements
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88-97	30,31	Install MY-SP
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112-117	35	Laser Cleanup
118-121	36	Secure for Shipment
122	36	Lab Cleanup

REV	DATE	ECO
A	4/17/79	2004 WDF
—	—	—
—	—	—
C	5/29/81	2668 WDF
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

REV	DATE	ECO
B	4/9/81	2627 WDF
—	—	—
D	2/30/81	2755 RW
E	11/6/81	2850 WDF
—	—	—
F	11/6/82 WDF	2958

SIZE A

DRAWING 970270

PREP BY W. Fountain

DATE 11/6/81

SHEET 1 OF 36

REV F

Molectron CORPORATION

MY TEST PROCEDURE

BISHOP GR REORDER CS/ACCUPRESS 2706

MY SERIES Nd:YAG LASER

FINAL ASS'Y AND TEST PROCEDURE

Introduction:

The laser system will be delivered from the Class 100 clean ass'y area to the semi-clean test area, lacking the following subass'ies: telescopes (MY32/33/35): diverging lens ass'y (MY34); amplifier head (MY34/35); 2nd polarizer ass'y, turning optics dust box ass'y, and harmonics box optical ass'ies (MY3x). The oscillator section will have been preliminarily He-Ne aligned per 970292. The basic electrical functions will have been checked out per 970308 (system), 970272 (oven controller card), and 970336 (master control card). The plumbing should be leak-free.

This procedure covers: final setting of m.c.c. timings; alignment and optimization of the oscillator; installation and alignment of the components on the second beam line; measurements for the Checklist and Test Report; and some clean-up activities. It does not comprehensively cover debugging.

Equipment Req'd

1) He-Ne Laser (1-4 mW), polarized horizontally

2) Adjustable mounting apparatus for He-Ne

3) Alignment disks (980191-1 & -2)

4) Scatterer (e.g. lens tissue)

5) Test Polarizer (mounted dichroic-plastic sheet)

6) IR card (Kodak IR Phosphor)

7) IR viewer w. iris (FJW or equiv.)

8) Rocket-red paper (in sealed plastic bag)

9) Glass-Absorber Power Meter Head (Scientech 38-0101; see Note A) plus Power Meter Display Module (Scientech 36-1001 or equiv.)

10) Flat-Black-Absorber Power Meter Head (Scientech 36-001; see Note B) plus Power Meter Display Module (Scientech 36-1001 or equiv.); this equipment req'd only for systems having UV (355 nm or 266 nm) output.

11) DL230 Monitor Telescope with DL231B or DL231C Monitor Etalon; this equipment req'd only for systems having MY-E or MY-SAM.

(12) Wedged fused-silica flat, in mount; this equipment not required for MY32-10 and MY33-10 systems that lack UV output.

(13) Fast Photodiode ass'y.

(14) Fast Oscilloscope.

NOTE A. A glass-absorber head is uncalibrated and therefore not useable if either the absorbing glass is cracked or the beam cannot be directed to an area of the glass that is free of pits. A glass-absorber head with crack-free absorbing glass is calibrated only when the beam is striking a pit-free area.

NOTE B. A flat-black absorber head is uncalibrated if it is missing enough of its absorbing black that grey areas can be seen. To repair, spray the thermal disc with 3M Nextel Velvet Coating 101-C10 Black Air Dry Enamel per the directions on the spray can, and allow to dry.

Definitions

Front Mirror: The resonator (osc.) end mirror nearest the output end of the laser chassis: the one on the right as you face the LC controls.

Rear Mirror: The resonator (osc.) end mirror nearest the umbilical end of the laser chassis: the one on the left as you face the LC controls.

Osc. Shipping spec.: 1064-nm laser output pulse energy; amplifier, harmonics oven(s), and harmonics beam-splitter(s) removed; see 970329 for values.

Amp. Shipping spec.: 1064-nm laser output pulse energy; amplifier, installed; harmonics oven(s) and harmonics beamsplitter(s) removed; see 970329 for values.

SHG Shipping spec.: 532-nm laser output pulse energy; THG oven and splitter removed; see 970329 for values.

THG Shipping spec.: 355-nm laser output pulse energy; see 970329 for values.

FHG shipping spec.: 266-nm laser output pulse energy; see 970329 for values.

E_A Amp. flashlamp input energy (from service subpanel meter) at which the MY34/35 shipping spec. is met (in Q-switched mode: see below).

E_L Osc. flashlamp input energy (from service subpanel meter) at which the osc. shipping spec. is met with Q SWITCH rotary switch set to LONG; laser is running in "long-pulse" mode.

E_S Osc. flashlamp input energy (from service subpanel meter) at which the osc. shipping spec. is met with Q SWITCH rotary switch set to INT.; laser is running in "short-pulse" or "Q-switched" mode.

E_H Highest osc. flashlamp input energy (from service subpanel meter) at which the laser does not lase, when the Q SWITCH rotary switch is set to EXT.; "holdoff".

NOTE: When the laser is operating correctly, $E_L < E_S < E_H$; also, when the input energy is set to one of E_L or E_S and the Q SWITCH rotary switch is changed between LONG and INT., the 1064-nm laser output pulse energy will be roughly 5% higher in long-pulse mode than in short-pulse mode.

Setup:

Put the laser chassis on the table, with the output ports away from the door; the chassis should be far enough down the table that a He-Ne laser can boresight the oscillator thru the aperture in the rear end panel. Put the power console between the table and the door's wall. Connect the hoses from the city water (after the filters) and drain, correctly to the console; make sure that the hoses are not kinked or twisted. Connect the power console line cord to the proper plug through the proper power conditioning transformer. Replace the system's remote control connector plug (P.D.C. P1) with the one wired to the test area's door interlock.

Integration & Test:

1) With the power cord not plugged into the AC receptable, verify that the outlet's voltage, phasing (Δ or Y), and frequency (50 or 60 Hz) are correct for this system.

2) Set the various switches, knobs, etc, as follows:

CITY WATER: should be valved off at source (NOT at power console).

ROOM ACCESS DOOR(S): closed.

POWER CONSOLE:
Fuseholders: check to see if loaded & tight
SERVICE/NORMAL switch: in NORMAL position
WATER circuit breaker: ON
CHARGING POWER SUPPLY circuit breaker(s): all OFF
CITY WATER VALVE: OPEN

CONTROL PANEL: KEY SWITCH in OFF position.

REMOTE CONTROL PENDANT: Q SWITCH rocker switch in NORMAL position.

SERVICE SUBPANEL:
OSCILLATOR/AMPLIFIER switch: in OSC position
OSCILLATOR and AMPLIFIER potentiometer knobs: both fully counterclockwise (CCW; these potentiometers have clutches rather than stops, so the end-of-travel indication is an increase in the torque required to turn the knob).

PULSE RATE switch: FIXED 10/20 position
VARIABLE potentiometer knob: roughly midrange
Q-SWITCH rotary switch: LONG position
VOLTAGE ADJUST pot: fully CW

SAM shutter (if present): closed

PFN CHASSIS (Rear): toggle switches S2 & S3 OFF

LS-30 INTERLOCK SYSTEM: ON/OFF switch in ON position; AUTO/MANUAL switch in AUTO position; HAZARD/SAFE switch in SAFE position; green lamps (only) on the display should now be illuminated.

3) Plug the power cord into the AC outlet. At this point, nothing in the power console or laser chassis should be active; if something is active, debug the system. Otherwise, insert the key into the KEY SWITCH and turn it to the ON position (1/4 turn CW). The POWER lamps on the power console and control panel should now be illuminated, and the fans in the power console should be audible, and moving air (exhaust thru rear of console).

4) If the laser is not delivered with a plastic cover sheet (to protect the unit from contamination when the covers are off), make one. Each person should now don clean-room garb (hood & smock): this should be worn, together with clean-room gloves when appropriate, whenever the laser chassis is uncovered & being worked on. Either the covers or the plastic sheet should be on the laser whenever the laser chassis is not being worked on. Remove the top covers of the laser chassis, if they are on. Ensure that the resonator locking screw & the baseplate-mounting shoulder screws are loose. Defeat the electrical interlocks (toward the rear of the laser chassis, on the cover support bar) by pulling up their plungers; the READY lamp on the control panel should now be illuminated. (If not, check for defeat of the harmonics box and PFN chassis electrical interlocks.)

5) Depress and hold the START button; this will start the water pump in the power console; check for water leaks; continue to hold this button depressed until all large bubbles have been purged from the system (as observed at the laser head tubing), then release; the pump should turn off. Add distilled or organic-free deionized water as req'd to fill the coolant reservoir 1/2-2/3 full. Allow a minute or so for small bubbles to coalesce, then repeat this step. Continue this process until no large bubbles appear.

System Turn-On; Interlock Check

6) If the CITY WATER OUT line has a valve at the drain, open this valve. While watching the WATER lamp (on the power console), open the valve to the CITY WATER IN line, slightly past the point where the WATER lamp is illuminated. (Turn it or the power console CITY WATER VALVE off during any debugging to avoid thermal stresses & possible "dewing")

7) Depress the START button and hold it until the ON lamps are illuminated. The water pump should now stay on. (The flash-lamps should still be off.)

8) Hold the SHUTTER rocker switch in the OPEN position until the shutter opens and the SHUTTER switch and SHUTTER OPEN lamps are illuminated; the delay from the time the ON lamps are illuminated should be roughly 10 sec.

9) Open the room access door; the shutter should close.

10) Leave the room door open so that you can see the display, but manually close the door interlock switch. Repeat step (8): on the LS-30 display, the yellow lamps (only) should be illuminated when the laser's ON lamps are illuminated but the shutter is closed, and the red lamps (only) should be illuminated when the laser's SHUTTER OPEN lamps are illuminated. Release the door interlock switch, & reclose the room door. (The shutter should now be closed.)

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REORDER 12706

11) Depress the STOP pushbutton & hold it until the ON lamps go out; this should also turn the pump motor off.

CAUTION!
To avoid shock, DO NOT TOUCH LASER HEAD

WHEN ITS SIMMER SUPPLY IS ENERGIZED!

12) Switch ON PFN Chassis toggle switch S2 only. Restart the laser. Look through the oscillator's rear mirror into the rod: if there is a white glow, the simmer supply is working. If absent or very unstable, debug simmer circuit.

13) Switch ON the oscillator charging power supply circuit breaker only. The osc. flashlamps should start flashing at the fixed rep. rate within about 3 sec.; also, the FULL CHARGE lamp (on the rear of the supply) should flash at the same rate, and the meter on the laser chassis service subpanel should read $\lesssim$ 12 J (MY32/34) or $\lesssim$ 25 J (MY33/35).

DANGER!

Every person in the enclosed laser area should be wearing proper and sufficient protective eyewear for 1064 nm before the next step is taken.

Oscillator Self-Alignment (Long-Pulse)

14) After verifying that all personnel are protected, open the shutter. Check with the IR card, between the 1st & 2nd polarizer locations, (i.e. between the intracavity & turning-optics thin-film polarizers) for lasing. If no lasing is observed, adjust the OSCILLATOR pot CW until lasing starts. If lasing is not observed even with the OSCILLATOR pot fully CW, STOP the laser, turn off the city water, set up a He-Ne laser, realign the YAG laser with the red beam, restart the YAG laser, & repeat this step (14). If lasing is still not observed, try rotating the $\lambda/4$ plate and the polarizer while watching the IR card for laser emission. If even this does not help, proceed to step (15); otherwise, skip to step (16).

15) Turn off the oscillator charging power supply & set up the He-Ne laser, lens tissue & the "Test Polarizer" so as to recheck Pockels cell alignment: when the shutter is closed, or when it's open & the Q SWITCH rotary switch is to LONG, you should see the normal cross-&-rings pattern (isogyre); when the shutter is open, the Q SWITCH rotary switch is to EXT or to INT, & the Q SWITCH rocker switch is to SINGLE SHOT, you should see a bright cross rather than a dark one; when the shutter is open, the Q SWITCH rotary switch is to INT, & the Q SWITCH rocker switch is to NORMAL, the display should flash at the fixed rep. rate, between dark cross & bright cross. If you discover a problem, fix it, remove the Test Polarizer, restart the laser, & return to step (14); if steps (14) & (15) have not identified the problem, the system still won't lase, & there's nothing (such as water or damage) fouling up the beam line, ask for help.

16) Adjust the resonator mirrors (only) for lowest laser threshold (keep the OSCILLATOR pot as far CCW as practical) & best beam symmetry (concentric circles) as seen on the IR card located between the polarizers. Move the IR card as far as practical "downstream" from the osc. polarizer & refine these adjustments, concentrating mainly on symmetry.

17) Turn the Q SWITCH rotary switch to EXT & set the Q SWITCH rocker switch to SINGLE SHOT. While surveying with the IR card for lasing, increase the input energy. As soon as lasing is observed, adjust the Pockels cell (only) to stop it; adjustment should primarily be horizontal. Continue to increase the input energy & adjust the Pockels cell until either lasing can no longer be held off by adjusting the Pockels cell or the input energy is all the way up (in this case, set the Pockels cell adjustments midway between the settings that allow lasing). Reduce the input energy to minimum & set the Q SWITCH rotary switch to LONG & the Q SWITCH rocker switch to NORMAL.

18) Turn off the oscillator charging power supply & set up the He-Ne laser, lens tissue, & "Test Polarizer" so as to recheck Pockels cell alignment. The cross of the isogyre pattern should appear to be offset slightly from the He-Ne beam, horizontally. If the cross is offset substantially, you have at least one of the following problems: YAG beam does not agree with He-Ne beam (this will be checked in step (19)); polarizer angle needs to be changed (this will be done in steps (25)-(35)); Pockels cell voltage is low (unlikely); Pockels cell is clamped too tightly (c.f. step 6 of 970292).

If the cross is offset slightly, don't readjust anything. If the cross is offset substantially, check to see whether the He-Ne is still truly boresighted to the YAG: if it is, recenter the cross by adjusting the Pockels cell; if it isn't, realign the He-Ne & redo theis step (18).

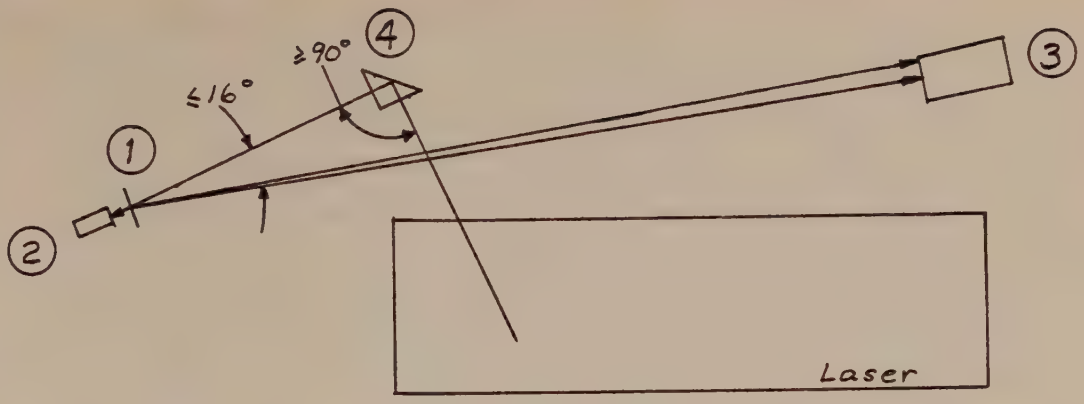
19) Close the shutter; remove the Test Polarizer & the aperture ass'y; reopen the shutter; ensure that the He-Ne is boresighted to the YAG; turn the osc. charging power supply back on; put the white card (with the cross) at the output end of the YAG so that the cross is centered on the He-Ne beam; turn off the He-Ne laser. While looking at the cross thru the IR viewer, turn up the input energy until you can see the image, near the cross, of that fraction of the laser beam that gets thru the front mirror. Look next (with the IR viewer) at the aperture on the front of the He-Ne, near which you should see the image of that fraction of the laser beam that gets thru the rear mirror (turn up the input energy some more, if req'd to see this spot). The two IR spots should be approximately centered on the cross & the He-Ne's aperture, respectively (they never will be exactly centered, since the IR YAG beam refracts slightly differently thru the system than does the red He-Ne beam). If the centers of the IR spots are not within about 1 mm of the centers of the cross & the He-Ne's aperture, "walk" the IR beam by adjusting the YAG mirrors until the YAG beam is as coincident with the He-Ne beam as you can make it.

Turn the input energy down to just above threshold. Close the shutter. Install the aperture ass'y & center the aperture on the He-Ne beam. Open the shutter. If you had to "walk" the IR beam, return to step (16); otherwise, "touch up" the aperture adjustments A/R for good beam symmetry & proceed to step (20).

Optimize Osc. Coupling (Long-Pulse)

20) Center the glass-absorber power meter head on the beam*, making sure that the back-reflection is not aligned back along the beam. Increase the input energy to obtain an output energy of about 80% of the osc. shipping spec. Rotate the $\lambda/4$ plate (about its axis) so as to maximize the output, reducing the input as necessary to keep the output between 80% & 100% of the osc. shipping spec., & finishing so that the $\lambda/4$ plate adjustment is optimized at an output of 100% of the osc. shipping spec. Reduce the input energy to slightly above threshold. Close the shutter; remove the aperture ass'y; open the shutter.

*For MY3x-20: set up similar to sketches on p. 10--DO NOT PUT FULL LASER OUTPUT DIRECTLY INTO POWER METER HEAD!



KEY:

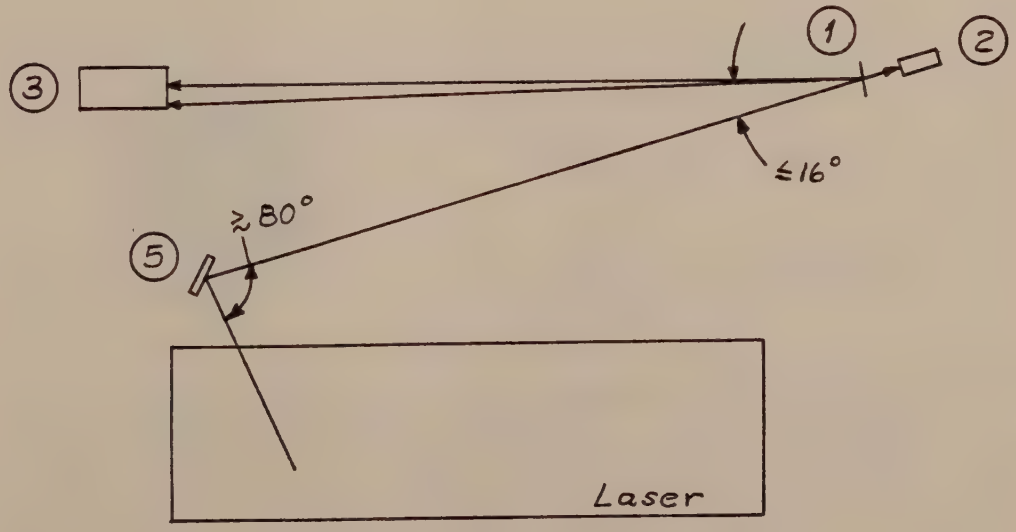
(1) WEDGED FUSED-SILICA FLAT

(2) BEAM DUMP

(3) POWER METER HEAD

(4) FUSED-SILICA PRISM (square faces "vee" AR-coated for 1064 nm)

(5) MIRROR (MAX. R @ 1064 nm, 45° inc.)



REV	DATE	ECO
REV	DATE	ECO
REV	DATE	ECO
REV	DATE	ECO

SIZE A | DRAWING 970270 | REV F

PREP. BY WDF | DATE 2/19/81 | SHEET 10 OF 36

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MY TEST PROCEDURE

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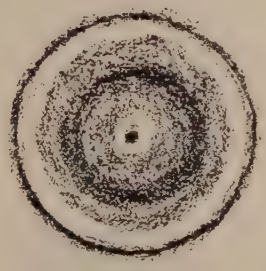
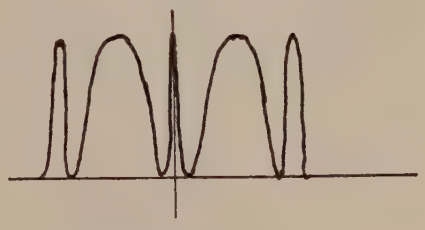
Oscillator Self-Alignment (Q-Switched)

21) Turn the Q SWITCH rotary switch to INT. This will probably stop lasing: check with the IR card, & (if necessary) increase the OSCILLATOR input energy (it should not take more than a few joules' change to reattain threshold). Set aside the IR card & put the "rocket red" paper (in its sealed plastic bag) between the two polarizer locations. Increase the OSCILLATOR input energy until the beam pattern is clearly visible (in orange). Tweak the resonator mirrors for best symmetry; you are looking for the diffraction pattern sketched below (the dark parts of the sketch are the bright parts of the pattern). Because the optics are not perfect, there may be darker &/or brighter areas that reduce the circular symmetry of the pattern & that change much more rapidly (with mirror adjustments) than does the pattern as a whole; these should be minimized, but need not be completely absent (however, very bright spots or lines are bad). It may be necessary to translate the Pockels' cell ass'y &/or the "outboard" ends of the laser head beam tubes (in order to eliminate glancing reflections). Be forewarned that it may not be possible to attain a recognizably "best" & symmetrical pattern in the case of the MY33/35; even if you do, it will not look like the sketch, although it will be circularly symmetric. If you can't recognize a pattern that's clearly good, set the mirrors for a pattern that's not bad (do the best you can, in other words), and proceed on from there (THIS APPLIES ONLY TO MY33/35!).



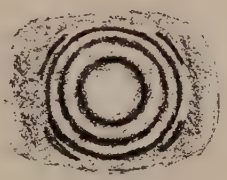


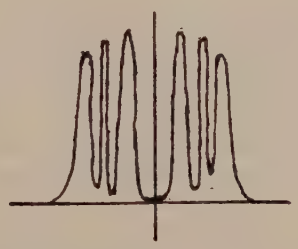
Brightness vs. Radius

Move the red paper as far "downstream" as practical (the pattern will be somewhat changed) & refine adjustments for best symmetry. With the laser in long-pulse mode, check that the YAG & He-Ne beams still coincide (c.f. step (19)): If they don't, return to that step; if they do, put the laser input just enough above threshold for stable output & proceed from here.

22) If the pattern you obtained in step (21), preceding, was very "clean" & clear, set the Q SWITCH rotary switch to INT & skip this step; otherwise, note the laser output energy. Look with the IR viewer (the IR card may also work) at the "rejected" beam, which reflects from the back of the polarizer & ends up on the wall of the polarizer dust box @ 180° from the output beam. Adjust the λ/4 plate in the direction that decreases the intensity of the rejected beam: continue to rotate in this direction until the intensity has gone thru a minimum (probably zero) & has started to increase again; continue in this direction until the output energy is back to the value noted in the first sentence of this step. Set the Q SWITCH rotary switch to INT. Looking at the output beam with the red paper, retweak the mirrors slightly A/R for the best pattern as in step (21). If the pattern of step (22) is no worse than the pattern of step (21), continue to step (23); if the pattern of step (21), was better, return to the λ/4 plate & mirror settings that you had then, & proceed to step (23).

23) Close the shutter. Reinstall the aperture ass'y. Open the shutter. With the red paper between the polarizer locations, adjust the aperture ONLY, for the most symmetrical pattern (change the oscillator input if req'd for adequate visibility). You are looking for a diffraction pattern of concentric circles something like the sketch (which is not necessarily accurate as to the number of circles; again, the dark parts of the sketch are the bright parts of the pattern). When you finish, there should not be darker or brighter areas that reduce the symmetry. In the case of the MY33/35, the pattern will have more rings than the sketch, & may have a (relatively weak) center lobe; the circular symmetry will very probably be worse than the sketch. Small "tweaks" on the mirrors will be O.K. after you've done the best you can with the aperture adjustments (THIS APPLIES ONLY TO MY33/35!).





Brightness vs. Radius

Move the red paper as far "downstream" as practical (the pattern will be somewhat changed) and refine aperture adjustments for best symmetry. (For MY33/35, also refine mirror adjustments A/R.)

Align Osc. Polarizer; Adjust Timing & Coupling

24) Set the Q SWITCH rotary switch to LONG and set the input energy just above threshold. If the polarizer is an "in-spec." unit mounted in a "nonadjustable" stand (0060-1062 or 0060-4582), do steps (26)-(30), and then skip to step (36); if the polarizer is mounted in a rotation/translation ass'y (0060-3701 or 0060-4901), proceed to step (25).

NOTE: Steps (25) thru (32) are intended to get the polarizer angle correct to within about 1°, relatively rapidly.

25) Temporarily attach a ruled card (e.g. a 3" x 5" file card) to the bottom cover of the laser chassis so that the beam passes just above the top of the card. Just below the beam, write the number 0 on the card; hereafter, each time you move the beam (or the card), write the move number just below the beam.

26) Increase the input energy to find E_L: Record E_L, if attained; reduce the input to threshold. (If E_L was not attained, skip to step (31).)

27) Set the Q-Switch mode to EXT.; increase the input energy fo find E_H, tweaking the Pockels cell as req'd; record E_H; reduce the input $\sim$ to threshold.

28) If $E_L \geq E_H$, set the Q-Switch mode to LONG and skip to step (31).

29) If $E_L < E_H$, set the Q-Switch mode to INT.; increase* the input energy to find E_S; record E_S; reduce the input $\sim$ to threshold, and set the Q-Switch mode to LONG.

30) Calculate and record the figure of merit: $FM = (E_H - E_S)/E_S$.

31) Rotate the polarizer per the next sentence so as to move the beam about ¼" (about 6 mm) at the card, and re-center the power meter head on the beam. Try the clockwise direction first if $E_L \geq E_H$ or $FM \leq 0$; try the counterclockwise direction first if E_L was not attained; if $FM > 0$, you'll just have to guess.

32) Repeat steps (26)-(31) as req'd to find the setting that yields the maximum positive value for FM. If you have to translate the polarizer ass'y to avoid clipping the beam, try not to change the angle, and don't forget to translate the card also. If you rotate the beam 3 or more increments from the "zero" position, check the beam profile and tweak the aperture, $\lambda/4$ plate, and rear mirror as req'd to retain good symmetry & efficiency.

---

* The first time you do step (29), set M.C.C. pot R6 to the most-clockwise setting (longest Q-switch delay) that does not reduce the output at E_S (if the output increases, lower the input accordingly), and CAUTIOUSLY rotate the $\lambda/4$ plate so as to maximize the output (lowering the input accordingly). Failure to adjust the $\lambda/4$ plate in minimal increments may damage the laser. The adjustment change, from the setting found in step (20), will be $\lesssim 5^{\circ}$: significant undercoupling will cause damage!

If you cannot find a setting that yields FM > 0, return to the setting that yields the least-negative value for FM, set the Q-switch mode to INT., and try step (34). If after that you cannot attain FM > 0, the polarizer probably is not useable.

NOTE: Steps (33) thru (35) are intended to get the polarizer angle and position "right on".

33) With the polarizer at the best setting found per step (32), translate the ass'y so that the beam is as far as possible from clipping; lock the translation setting.

34) Repeat steps (26)-(31) as req'd to maximize the FM, EXCEPT observe the following changes: each time step (28) is done, optimize (if req'd) the back mirror and the aperture for best beam profile, and check the $\lambda/4$ plate setting, then recheck E_H; in step (31), use increments of 1/16" (1½ mm).

35) Set the Q SWITCH rotary switch to LONG and set the input energy just above threshold. Close the shutter and lock the rotation setting (i.e. at the best FM). Skip to step (37).

36) If necessary, close the shutter; loosen the socket-head cap screws (that hold the polarizer mount to the "hockey puck") ¼ turn; open the shutter. Rotate the polarizer mount so that the output beam passes over the center of the centering pin for the second polarizer ass'y. Close the shutter and tighten the polarizer mount cap screws.

Align 2nd Beam Line (Preliminary)

37) Install the following items, leaving the mounting screws backed off about ¼ turn from tight: turning optics & dust box ass'y; 2nd polarizer ass'y. Open the shutter. To the extent req'd, translate the 2nd polarizer ass'y so that the beam is centered on it (use the IR viewer to determine this) and tighten the translation locking screws (with the beam blocked). Similarly, rotate the 2nd polarizer so that the beam is centered on the first turning mirror and lock the rotation adjustment (note: if the beam is now not centered vertically on the first turning mirror, one of the polarizers is probably mismounted). Similarly, center the beam (horizontally) on the second turning mirror and screw down the first turning mirror; then use the first turning mirror's button-head screws to do any req'd vertical centering. Using the IR card at the laser's IR output port (move the beam dump, if necessary), center the beam (horizontally) on that port and screw down the second turning mirror; then use the second turning mirror's button-head screws to do any req'd vertical centering. If necessary, adjust the harmonics box to the beam.

Interim System Check

38) For MY3x-20, set up the glass-absorber power meter head per sketches on p. 24--DO NOT PUT FULL LASER OUTPUT DIRECTLY INTO POWER METER HEAD! For MY3x-10, center the glass-absorber power meter head on the beam, making sure that the back-reflection is not aligned with the input beam. Turn the Q SWITCH rotary switch to INT. Increase the input energy while watching the beam pattern on the red paper (at the output end of the harmonics box or as much further "downstream" as is convenient): if the pattern becomes unsymmetrical, the beam may not be well centered in the

rod*. Remove the red paper when it (or its bag) starts to damage, or when the pattern is too bright to see details, whichever occurs first.

*It may be possible to reattain good symmetry by tweaking the aperture and/or both mirrors; in this case recheck the pattern at low power and, if it's good, you can proceed on. Alternately, <u>if</u> the beam is "breaking up", try small changes of the Pockels cell adjustemnt settings: if this doesn't cure the problem, either E_S is too close to E_H or you need to ask for help.

39) Increase the input energy to E_S (the value found in this step should be quite close to that in step (34); if not, the 2nd polarizer and/or one or both turning mirrors may be insufficiently reflective, and/or the harmonics box IR window and/or the 1064-nm $\lambda/2$ plate may be too reflective). Recheck the settings of M.C.C. pot R6 and of the osc. $\lambda/4$ plate (c.f. *note to step (29), on p. 13). Set the Q SWITCH rocker switch to SINGLE SHOT: the power meter reading should drop toward zero. Check for lasing with the IR card: if any is observed, tweak the Pockels cell (only) for best holdoff (if you can't now get $E_H > E_S$, you must go back to step (24) or possibly even to step (18); check the age of your polarizers to see if they are too new to have stabilized). Record this step's value for E_S (call it E_{39}) for later use. If there are no harmonics, lock the aperture adjustment (reduce power and watch the pattern while doing), then skip to step (50); otherwise, reduce the input energy to minimum; set the Q SWITCH rocker switch to NORMAL; set the Q SWITCH rotary switch to LONG; STOP the system (don't forget to turn off the city water), but leave the key switch ON.

<u>SHG Preliminary Setup & Alignment</u>

40) Plug in the SHG oven ass'y (i.e. the first one, if this system has MY-2SH rather than MY-SHG), and install it in its mount. Install the pair (or, the first pair) of SHG beamsplitters (if the system has MY-2SH, or has FHG but not THG, use the "upstream" pair of locations; otherwise use the "downstream" pair); leave the socket-head cap screws (in their bases) backed off about ¼ turn from tight. Adjust the oven mount (with the first thumbwheel) so that the output end of the oven is tilted slightly toward you. Get the system lasing slightly above threshold. With the IR card and/or viewer, make sure that the beam is not being clipped by the oven (adjust the transverse position of the oven mount, and/or adjust the turning mirrors, if necessary). Put a 3" x 5" card (or part of one -- <u>cut</u> it, if a narrower card is desired, but DON'T TEAR IT!) after the oven; you may (or may not) see some weak green light on the card.

Continue (with the thumbwheel) to tilt the output end of the oven toward you, checking occasionally to ensure that the beam is not being clipped; as the tilt approaches 3.6°, you should see green light that grows stronger and weaker periodically with angle. The amount of green observed at the correct angle will be very clearly more than at any other peak. Rotate the IR λ/2 plate to maximize the green (if you never do see green, rotate the λ/2 plate about 10° and redo this step (40)).

41) To the extent necessary: adjust the turning mirrors to center the beam on the first beamsplitter (retweaking the oven angle as necessary), and transversely center the oven mount on the beam (so that the beam is decentered by equal and opposite amounts at each end of the oven, with the oven correctly angled).

42) Close the shutter. Install the 532-nm λ/2 plate ass'y (slightly tilted), if present, and the beam dump, in each case leaving the socket head cap screws (in the mounts) backed off about ¼ turn from tight. Move the power meter head to the green output port. Open the shutter. Center the beam on the second splitter and screw down the first (with the beam blocked). Center the beam on the green output port and screw down the second splitter. Adjust the beam dump to the IR beam and the power meter head to the green beam. If this system has MY-2SH, repeat steps (40) thru (42) for the second SHG oven ass'y & beamsplitter pair; the add'l waveplates need not be installed at this time. Unless this system has MY-THG or MY-TH2, skip over step (43).

NOTE: Hereafter, MY-2SH & MY-TH2 will be ignored (we sell about one per year, & this procedure is less confusing if we don't address them); see the MY Service Manual, if this system has one or both.

THG Preliminary Setup & Alignment

43) Close the shutter. Remove the first SHG splitter to a storage position. Plug in the THG oven ass'y & install it in its mount. Adjust the mount (with the second thumbwheel) so that the output end of the oven is tilted slightly up. Install both THG beam splitters (cap screws ¼ turn loose). Open the shutter. With the white card, make sure that the beam is not being clipped by the oven (adjust the transverse position of the oven mount, if necessary; then adjust the turning mirrors, if necessary).

DANGER!

Every person in the enclosed laser area should be wearing proper and sufficient protective eyewear for 1064 nm and harmonics before the next step is taken.

See DANGER note at bottom of previous page.

44) After verifying that all personnel are protected, turn the Q SWITCH rotary switch to INT. Put a white card between the SHG oven ass'y & the first beam splitter, & increase the input energy unitl the green beam is clearly visible. By eye, optimize the settings of the $\lambda/2$ plate & the SHG oven tilt. Remove the white card. Unless this system has THG, skip to step (48).

45) Place a white card between the second THG splitter & the UV output window. Use the red paper before & after the second THG splitter to roughly align the THG splitters (using the residual green along that path: there probably is not enough UV to see at this point); do not intercept the main green beam with the red papaer. Continue (with the thumbwheel) to tilt the output end of the oven up, checking occasionally (with a white card) to ensure that the beam is not being clipped. At about 3.6° tilt, enough UV will be generated to cause the white card in the UV beam line to fluoresce bluish white (if you never do see this, replace the white card with the red paper & try again: the red paper is more sensitive to the UV, but also to the residual green, & hence can be more confusing to use, than the white card).

46) To the extent necessary: CAREFULLY adjust the positions of both ovens & adjust the turning mirrors (retweaking oven angles as necessary) so that everything along the IR beam line in the harmonics box is as well centered on the beam as it can practically be. Center the UV beam on the second THG splitter & screw down the first (with the beam blocked). Center the beam on the UV output port & screw down the second THG splitter.

47) Close the shutter. Remove the first THG splitter to a storage position. Remove the THG oven from its mount & put it aside at a storage position. Restore the first SHG splitter to its operating position. Open the shutter.

Optimize Osc. Coupling & Timing (Q-Switched)

48) Put a white card between the first SHG splitter & the IR output port. Increase the input energy slowly to E_{39} while monitoring the beam profile (on the white card -- because of the limited acceptance angle of the SHG xtal, you may have to rock the SHG thumbwheel to see all of the beam, especially at low power); tweak the aperture adjustments (&--but only if necessary!--the resonator mirrors) to retain best beam symmetry during this process; IF you see the spatial profile break up, tweak the Pockels cell pitch and/or yaw A/R to eliminate break-up. At E_{39}, optimize (while watching the power meter) the $\lambda/2$ plate & oven angle settings & then (CAREFULLY!) the oscillator $\lambda/4$ plate setting.

49) Observe the power meter reading while adjusting master control card pot R6. (This adjusts the Q-switch delay relative to the osc. flashlamps.) The proper setting is the most-

clockwise setting that still provides maximum output. If you see a large change, redo steps (39), (42), & (43). Set the input energy to slightly above threshold and close the shutter.

Profile Footprints

50) Remove the aperture & open the shutter. Using footprint paper in a sealed plastic bag, make a footprint of the beam between the polarizers (adjusting the input A/R). Reinstall the aperture (shutter closed) & adjust (using red paper in its bag). Make another footprint, & attach the footprints to the Test Report. Set the input slightly above threshold & close the shutter. Turn the Q SWITCH rotary switch to LONG. Unless this system is an MY32/33 with a reducing telescope, skip to step (53).

MY32/33 Reducing (Input) Telescope

NOTE: Steps (51) & (52) apply only to MY32/33.

51) Install the reducing (input) telescope ("+" lens at the input end; both lens cells screwed all the way in), leaving the base-mounting screws about ¼ turn loose. If this system has THG, install that oven. Open the shutter. With the aid of the IR card, approximately center both ends of the telescope on the beam, starting with the "+" end. Next, adjust the position & orientation of the telescope, if necessary, to center the beam as well as you can thru the harmonics box & its contents: translating or angling the telescope will respectively translate or angle the beam. Finally, if necessary, refine the centering by adjusting the truning mirrors. Screw down the telescope mount. If the THG oven is installed, remove it to a storage position (with the shutter closed, of course).

Turn the Q SWITCH rotary switch to INT. Increase the input energy to the point where the green beam can be seen on a white card. By eye, optimize the SHG oven tilt. Check that the beam is reasonably well centered everywhere, & that the power meter head is correctly adjusted to the green beam.

Increase the input energy to E_{39}. Adjust the oven & $\lambda/2$ plate settings to maximize the green power reading.

52) Block lasing by inserting a white card in the beam at the shutter. Starting with the "-" end, increase the separation of the telescope lenses by unscrewing the lens cell by some number of whole (360^{o}) turns (say, 4 or 5, initially; 2, toward the end of this process). Remove the white card. Tweak the oven setting so as to maximize the green power reading. Repeat this process (alternating ends) unitl you have reached (or slightly

passed) the setting that provides peak power, & then refine the separation (in whole-turn increments) to optimum. If this system has neither THG nor FHG, lock the telescope adjustments. Reduce the input energy to slightly above threshold, & turn the Q SWITCH rotary switch to LONG.

Find E_S

53) Along the IR beam line (with shutter closed, of course): remove any & all harmonic beam splitters & ovens to storage positions. Move the beam dump out of the IR beam line. Move the power meter head to the IR output port, & adjust it to the beam*. Turn the Q SWITCH rotary switch to INT. Adjust the input energy to find E_S, & record E_S in the OSC. INOUT JOULES space of Test Report 970307.

*For MY3x-20, set up the power meter head per one of the sketches on p. 24--DO NOT PUT FULL LASER OUTPUT DIRECTLY INTO POWER METER HEAD!

Redo Osc. Input Limit/Calibrate (A/R)

54) A. MY32/34 ONLY

If the value for E_S from step (53) is less than 29 J or more than 36 J, turn the system completely off (including KEY SWITCH & city water). Discharge the PFN capacitors with a grounding stick, & unplug the AC line cord. Do the following steps, modified as noted, of Electrical Checkout Procedure 970308: step (12A)--in the equation for V1, replace "29.97" by "$5.256\sqrt{E_S}$", & adjust mcc R1 for a reading of "$1.2E_S$" rather than "39"; step (13)--replace "39" by "$1.2E_S$"; & step (14)--replace "19" by "$0.6E_S$".

B. MY33/35 ONLY

If the value for E_S from step (53) is less than 46 J or more than 57 J, turn the system completely off (including KEY SWITCH & city water). Discharge the PFN capacitors with a grounding stick, & unplug the AC line cord. Do the following steps, modified as noted, on Electrical Checkout Procedure 970308: step (12B)--in the equation for V1, replace "56.04" by "$7.861\sqrt{E_S}$", & adjust mcc R1 for a reading of "$1.2E_S$" rather than "61"; step (13)--replace "61" by "$1.2E_S$"; & step (14)--replace "31" by "$0.6E_S$.

Reset System Conditions

55) A. MY35 ONLY

Get the system lasing, slightly above threshold, in the long-pulse mode. Close the shutter &, at this point,

go directly to step (56).

B. MY 32/33/34 ONLY

Get the system lasing @ E_S in the short-pulse mode. If the system is an MY34, skip to step (58); otherwise, skip to step (71).

MY35 Interstage Telescope

NOTE: Steps (56) & (57) apply only to MY35.

56) Install the interstage telescope ("+" lens at the input end; lens cell screwed all the way in), leaving the base-mounting screws about ¼ turn loose. Open the shutter. With the aid of the IR card, approximately center both ends of the telescope on the beam, starting with the "+" end. Next, adjust the position & orientation of the telescope, if necessary, to center the beam as well as you can thru the harmonics box & its contents: translating or angling the telescope will respectively translate or angle the beam. Finally, if necessary, refine the centering by adjusting the turning mirrors. Screw down the telescope mount. Block the harmonics box input with a white card. Increase the input energy to E_{39}.

57) With "footprint" paper (in a sealed plastic bag!) check the beam size at the amplifier head location: if the beam does not fit within a 9-mm-dia. circle, you will need to adjust the lens separation. Block lasing by inserting a white card in the beam at the oscillator shutter. Increase the separation of the telescope lenses by unscrewing the lens cell* by some number of whole turns (say, 4 or 5, initially; 1 or 2, toward the end of this process). Remove the white card & take another footprint. Repeat this process until the beam fits within a circle that has a diameter neither greater than 9 mm nor less than 8.5 mm. Reduce the input energy to slightly above threshold, & turn the Q SWITCH rotary switch to LONG. Skip to step (59).

* It may become necessary to convert the -1 telescope to a -2 telescope & return to step (56), if the adjustment range of the -1 version is not large enough for the particular lenses & oscillator used.

MY34 Diverging Lens (A/R)

NOTE: Step (58) applies only to MY34

58) With "footprint" paper (in a sealed plastic bag!) check the beam size at the amplifier head location: if the beam clearly fits within a 7-mm-dia. circle, you will need to install the diverging lens (& possibly to readjust the turning mirrors) before installing the amplifier head. Reduce the input energy to slightly above threshold, & turn the Q SWITCH rotary switch to LONG. If req'd, install the diverging lens (with the beam blocked) & check beam alignment, making any needed adjustments.

MY34/35 Amp. Installation

NOTE: Steps (59) thru (70) apply only to MY34/35.

59) STOP the system & shut off the city water. Install the amplifier head (without its beam tubes), leaving the (4) lock-down screws about ¼ turn loose (do not make any electrical connections at this time, however). Turn the system back on & (after checking for water leaks), with the IR card & viewer, approximately center the head on the beam. Use the methods sketched on the next page to refine the centering & tilt of the head. Turn the Q SWITCH rotary switch to INT & increase the input energy enough to see the beam with the red paper. Use a narrow strip of red paper (sealed in plastic--BEWARE OF THE BACK-REFLECTIONS FROM THE PLASTIC: MAKE SURE THAT THEY'RE DIRECTED AWAY FROM YOU & ANY OTHER PERSONNEL AT ALL TIMES!) to check the centering of the head on the beam. Install & adjust, A/R, ovens & beamsplitters in the IR beam line of the harmonics box (c.f. steps (40) thru (46)), to ensure that the beam goes as nearly as practicable thru the center of each item. Screw down the amplifier head, recheck the alignment of the head & the harmonics box items to the beam, & shut the system down completely.

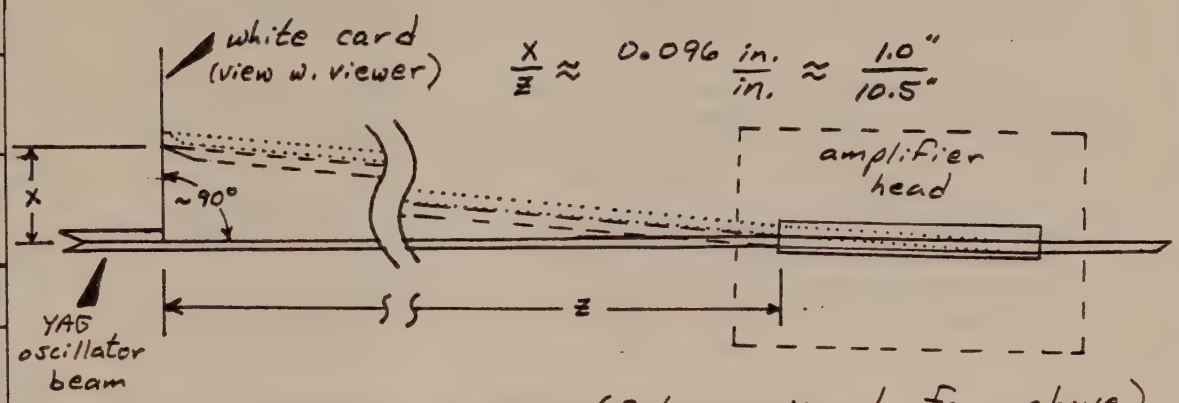
CAUTION!

To avoid shock, DO NOT TOUCH A LASER HEAD WHEN ITS SIMMER SUPPLY IS ENERGIZED!

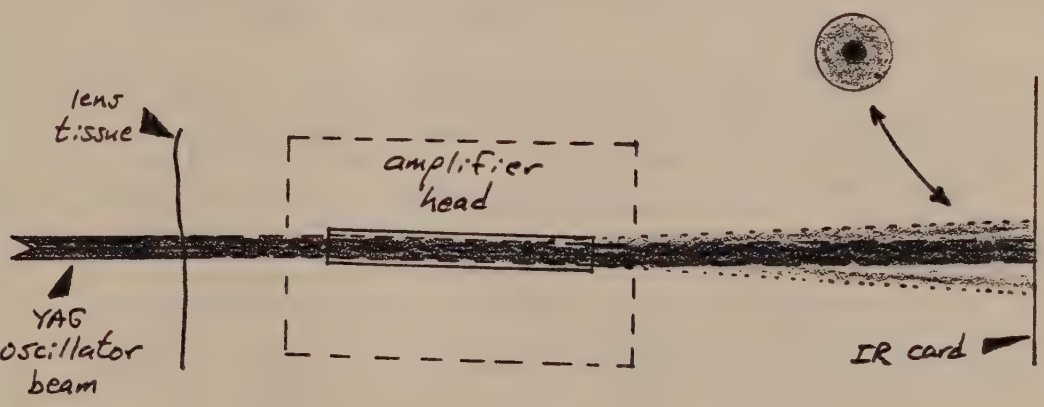
60) Make all electrical connections to the amplifier head. Switch on PFN Chassis toggle switch S3. Turn off the osc. charging power supply circuit breaker. Restart the system (shutter closed). With a dental mirror &/or with the room lights dimmed, check for amplifier simmer (c.f. step (12)).

61) After verifying that all personnel are wearing proper eye protection, turn on the oscillator charging supply circuit breaker, open the shutter, & position yourself so that you can see the input end of the amplifier rod. (If possible, another person should be positioned so as to see the parts of the rod that you can't--otherwise, you will have to move around so as to perform both tasks.) Turn off the main room lights (you should have a pen-light, flashlight, microscope illuminator, or similar, lit or immediately to hand).

Slowly & carefully increase the oscillator input/output while watching for plasmas (rather dim, white flashes) on the rod nut (i.e. just outside the rod, proper).



TILT CHECK (set-up viewed from above)



CENTERING CHECK

REV	DATE	ECO

SIZE A

DRAWING 970270

PREP. BY WDF

DATE 4/11/94

SHEET 22 OF 36

REV F

Molectron CORPORATION

MY TEST PROCEDURE

If any are observed, adjust the second turning mirror (beam centering) &/or (MY35) increase the telescope lens separation in whole turns per step (57) (to reduce beam size), as appropriate. Continue this process until the oscillator input is E_S and no plasmas can be seen at the amplifier input. If the second turning mirror's orientation was not changed, go directly to step (62) at this point; otherwise, get the system lasing slightly above threshold in long-pulse mode, go back to step (59), & proceed on from there thru steps (60) & (61) again.

62) STOP the system. Install the amplifier beam tubes. Switch OFF the osc. charging power supply & switch ON the amp. charging power supply (or, ganged supplies, for the MY34-20). START the system. The amp. flashlamps should start flashing at the fixed rep. rate within about 3 sec.; also, the FULL CHARGE lamp (on the rear of the supply) sould flash at the same rate. Verify that the meter reading is $\sim<$ 25 with the AMPLIFIER pot (R3) fully CCW, & close to 80 with R3 fully CW: leave R3 fully CCW.

MY34/35 Amp. Optimization; Find E_A

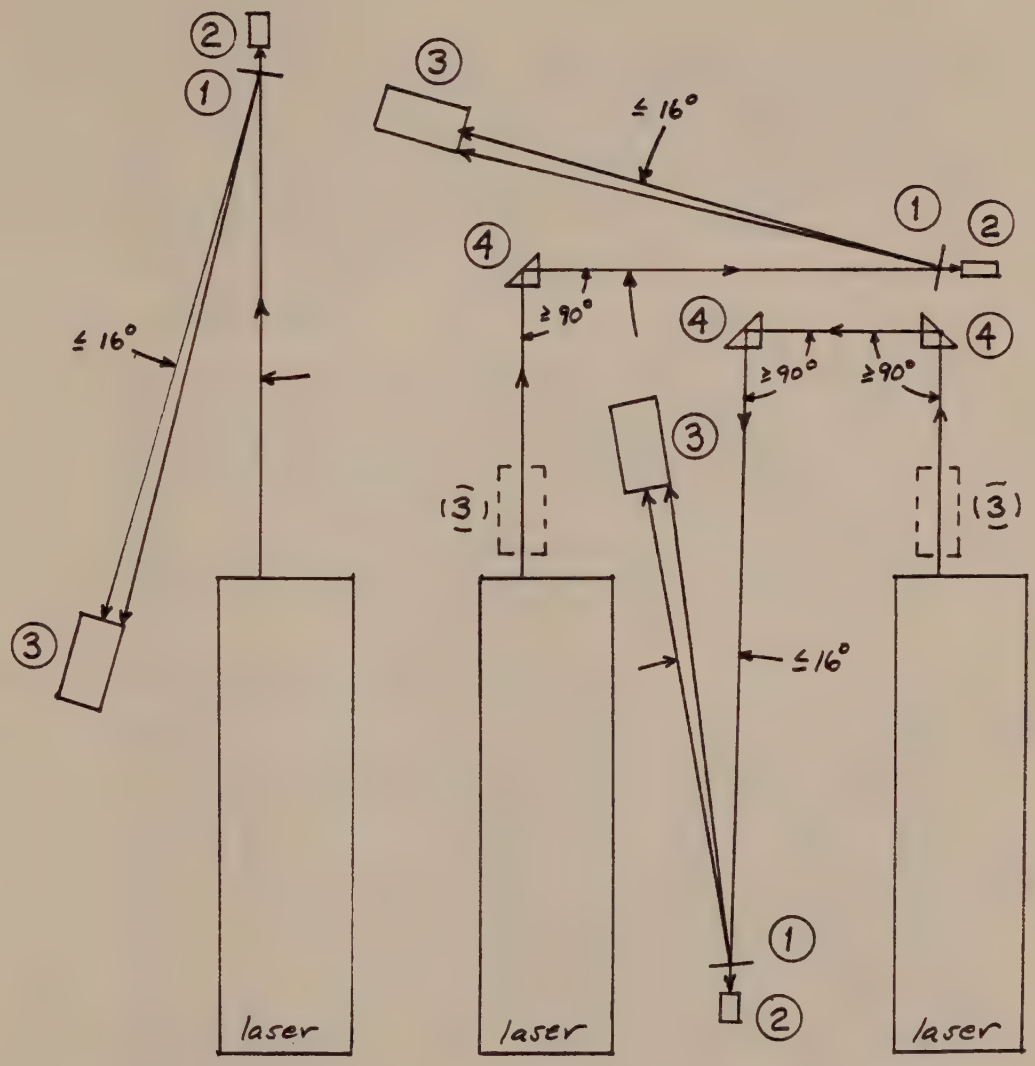
63) After verifying that all personnel are protected, turn on the oscillator charging power supply circuit breaker, open the shutter, & increase the oscillator input to E_S. Adjust master control card potentiometer R4 for maximum laser output (this adjusts the delay between the osc. & amp. flashlamps).

64) Turn off the amplifier charging power supply circuit breaker. Reduce the oscillator input energy to slightly above threshold. Turn the Q SWITCH rotary switch to LONG. Set up the power meter head, etc., as shown in one of the sketches on the next page. Do not allow the back reflection(s) from any component (including the power meter head) to re-enter the laser. If you do not use any turning prisms, or if the turning prisms are "vee" AR-coated for the wavelength you're measuring, skip now to step (65) & then to step (68); otherwise, put the power meter head between the laser & the first turning prism (again, control the back reflection).

65) Turn the Q SWITCH rotary switch to INT. Increase the oscillator input to E_S. Note the output energy. Turn on the amplifier charging power supply circuit breaker.

66) Take an output power reading; call it P_{66}. Move the power meter head to one of the split-off beams (close the shutter while relocating the head), & adjust it correctly. Check to see that no significant amount of laser radiation is missing the prism(s). If necessary, tweak the position(s) of the prism(s), etc.

BISHOP GRAPHICS/ACCUPRESS
REORDER A12706



① wedged f.s. flat ③ power meter head

② beam dump ④ f.s. prism (pref. vee-coated)

REV	DATE	ECO
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SIZE: A
DRAWING: 970270
PREP. BY: WDF
DATE: 2/19/81
SHEET 24 OF 36
REV: F

Molectron CORPORATION

MY TEST PROCEDURE

67) Take an output power reading; call it P_{67}. Calculate $K=P_{66}/P_{67}$. Skip to step (69).

68) Obtain K from the table on p. 3-20 of the Installation, Operation & Maintenance Manual.

69) A. MY34 ONLY

Increase the amplifier input, tweaking MCC pot R4 A/R, until the output reaches the amplifier shipping spec.; call this input E_A. If the output noted in step (65) was $\lesssim$ 80% of the osc. shipping spec. AND the diverging lens is installed AND you have trouble meeting the amp. shipping spec., then remove the diverging lens, readjust the second beam line A/R per steps (58) ff., & try again from step (61).

B. MY35 ONLY

Increase the amplifier input, tweaking master control card pot R4 as required, until whichever comes first: the amplifier input is 70, or the output reaches the amplifier shipping spec. Then increase the lens separation per step (63) (if it helps) & adjust R4 (if it helps) & the amplifier input to obtain the amplifier shipping spec. at as low an amplifier input as you can. DO NOT DECREASE the lens separation below the value at the end of step (61)! Call this latter input E_A.

Redo Amp. Input Limit/Calibrate (A/R)

70) Record E_A in the AMP. INPUT JOULES space of Test Report 970307. If E_A is less than 60 J or more than 73 J, turn the system completely off (including KEY SWITCH & city water). Discharge the PFN capacitors with a grounding stick, & unplug the AC line cord. Do the following steps, modified as noted, of Electrical Check-out Procedure 970308 (at this point, the ganged power supplies of the MY34-20 may be treated as a single supply--ignore the Slave's FULL CHARGE lamp): step (15)-- in the equation for V2, replace "64.18" by "$7.861\sqrt{E_A}$", & adjust MCC R2 for a reading of "$1.2E_A$" rather than "80"; step (16); & step (17)--replace "80" by "$1.2E_A$".

Remaining IR Measurements

71) With the oscillator input set to E_S & (MY34/35) the amplifier input set to E_A, do the appropriate measurements & fill in the following boxes of Test Report 970307:

"FIXED 10/20"-Hz Pulse Energy: 1064 nm;
FULL ENERGY REP RATE ...;
LASER PULSE DELAY FROM Q-SW SYNC;
LASER PULSE JITTER FROM Q-SW SYNC;

OUTPUT STABILITY: 1064 nm;
"Q-SWITCH TRIGGER" input (use "delay test box");
"SINGLE SHOT" (PFN:J4 should read +3.508 V to +3.652 V);
"LAMP TRIGGER" input (shutter should close for out-of-range).

(If this system has no harmonics, also fill in:

BEAM QUALITY).

The shutter may now be closed. Fill in:

"Q-SWITCH SYNC" output;
"LAMP SYNC" output;
"FIXED 10/20" pulse rate;
"VARIABLE" pulse rate;
EVEN COUNTER (except FINAL READING).

If this system has no harmonics, skip to step (81); otherwise, proceed to step (72), with shutter open.

SHG Final Setup & Measurements

72) Reduce the amplifier input to minimum. Reduce the oscillator input to as low a value as will still activate the red paper (placed after the amplifier or telescope). With the shutter closed, install the SHG oven, both SHG beam splitters, the 532-nm $\lambda/2$ plate (if any), & the beam dump. If this system does not have an amplifier (MY32/33), position the power meter head at the green output port; otherwise (MY34/35), set up the power measurement system (for green light) per one of the sketches of page 24. Increase the oscillator input to E_S & then maximize the green power by adjusting the oven tilt & the 1064-nm $\lambda/2$ plate rotation. If this system does not have an amplifier (MY32/33), skip to step (73); otherwise (MY34/35), obtain K_{532} per steps (66) & (67) or per step (68), whichever is appropriate. Increase the amplifier input to E_A & tweak the oven & 1064-nm $\lambda/2$ plate settings to optimum. For the MY35 only, also try increasing the lens separation per step (57), if it helps, until the 532-nm output is maximized. For the MY34 only, if you have trouble meeting the green shipping spec. AND the diverging lens is installed, then remove the diverging lens, readjust the second beam line A/R per steps (58) ff., & try again from step (61). For MY34/35 only, be alert for beam break-up; if it occurs, tweak the Pockels cell &/or reduce the osc. input slightly A/R to eliminate it.

73) Do the appropriate measurements (don't forget to subtract the residual IR) & fill in the following boxes of Test Report 970307:

"FIXED 10/20"-Hz Pulse Energy: 532 nm.
BEAM QUALITY
OUTPUT STABILITY: 532 nm.

If the system has neither THG nor FHG, skip to step (81). If the system has FHG but not THG, skip to step (76).

THG Final Setup & Measurements

74) Reduce the amplifier input to minimum. Reduce the oscillator input to as low a value as will still allow the green beam to be seen on the white card. With the shutter closed, remove the first SHG splitter to a storage position, & install the THG oven, both THG beam splitters, & the 355-nm $\lambda/2$ plate (if any). Set up the power measurement system (for UV radiation--use the power meter head with the flat black absorber--DO NOT USE THE GLASS-ABSORBER HEAD!) per one of the sketches of page 24. Obtain K_{355} per steps (66) & (67) or per step (68), whichever is appropriate. Increase the oscillator input to E_S & then maximize the UV power by adjusting the oven tilts & the 1064-nm $\lambda/2$ plate rotation (see p. 3-10 of the Installation, Operation, & Maintenance Manual). Increase the amplifier input to E_A & retweak these adjustments, &/or optimize the telescope setting (in single-whole-turn increments--(see step (52) or (57)) & lock the telescope adjustments.

75) Do the appropriate measurements (don't forget to subtract the residual IR + green) & fill in the following boxes of Test Report 970307:

"FIXED 10/20"-Hz Pulse Energy: 355 nm;
OUTPUT STABILITY: 355 nm.

If the system does not have FHG, skip to step (81); otherwise, with the shutter closed: move the SHG beam splitters so as to drive the FHG ass'y, & move the THG oven & beam splitters to storage positions.

FHG Preliminary Setup & Alignment

76) Reduce the amplifier input to minimum. Reduce the oscillator input to as low a value as will still allow the green beam to be seen on a white card. With the shutter closed, install the FHG oven, both FHG beam splitters, & the 266-nm $\lambda/2$ plate (if any), in each case leaving the base-mounting socket head cap screws about ¼ turn loose. Adjust the oven mount (with the third thumbwheel) so that the output end of the oven is tilted slightly up. Open the shutter. With the white card, make sure that the oven is not clipping the beam

(adjust the transverse position of the oven mount, if necessary; then, if necessary, adjust the SHG splitters &/or turning mirrors).

77) Place a white card between the second FHG splitter & the UV output window. Use the red paper before & after the second FHG splitter to roughly align the FHG splitters (using the residual green along that path: there probably is not enough UV to see at this point); do not intercept the main green beam with the red paper. Continue (with the thumbwheel) to tilt the output end of the oven up, checking occasionally (with a white card) to ensure that the beam is not being clipped. At about 3.6° tilt, enough UV will be generated to cause the white card in the UV beam line to fluoresce bluish white (if you never do see this, replace the white card with the red paper & try again: the red paper is more sensitive to the UV, but also to the residual green, & hence can be more confusing to use, than the white card).

78) To the extent necessary: CAREFULLY adjust the positions of both ovens & adjust the SHG beam splitters & turning mirrors (retweaking oven angles as necessary) so that everything in the harmonics box is well centered on the beam as it can practically be. Center the UV beam on the second FHG splitter & screw down the first (with the beam blocked). Center the beam on the UV output port & screw down the second FHG splitter. NOTE WELL: if this system has previously been aligned thru the THG oven & first THG splitter, the turning mirrors & SHG oven should probably not be touched during the centering phase of this step!

FHG Final Alignment & Measurements

79) Set up the power measurement system (for UV radiation--use the power meter head with the flat black absorber--DO NOT USE THE GLASS-ABSORBER HEAD!) per one of the sketches of page 24. Obtain K_{266} per steps (66) & (67) or per step (68), whichever is appropriate. Increase the oscillator input to E_S & then maximize the UV power by adjusting the FHG oven tilt (see pp. 3-10, 3-11 of the Installation, Operation & Maintenance Manual); if this system has THG & you performed steps (74) & (75), you will also initially have to adjust the settings of the 1064-nm $\lambda/2$ plate & the SHG oven. Increase the amplifier input & retweak the FHG adjustment; continue this until the stable FHG output is maximized or until the amplifier input is E_A, whichever occurs first. If this system has telescopes (MY32/33/35) but not THG, optimize the input telescope setting (in single-whole-turn increments--see step (52) or (57)) & lock the telescope adjustments.

80) Do the appropriate measurements (don't forget to subtract the residual IR + green) & fill in the following boxes of Test Report 970307:

"FIXED 10/20"-Hz Pulse Energy: 266 nm;
OUTPUT STABILITY: 266 nm.

VOLTAGE ADJUST Check

81) Reduce the amplifier input to minimum. Reduce the oscillator input to a level at which the green beam can be viewed comfortably on a white card (or, if no harmonics, to a level that satisfactorily acttivates the red paper). Turn the Q-SWITCH rotary switch to EXT. Check for IR laser output with the IR card (there should be none at this point). Turn the VOLTAGE ADJUST pot CCW until lasing is observed, & then turn it fully CW. Turn off the amp. charging supply, turn the Q SWITCH rotary switch to LONG, & set the oscillator input slightly above threshold. If the system has MY-SP but not MY-E, skip to step (88). If the system has MY-SAM but not MY-E or MY-SP, skip to step (98). Otherwise, skip to step (110).

Install MY-E

82) Install the MY-E etalon ass'y, using the He-Ne laser to ensure that it is tilted approx. 3/4° horizontally only (to either side; the angle between the incident & reflected red beams will be approx. 5/16" per foot or 26 mm per meter).

83) Turn the Q SWITCH rotary switch to INT & open the shutter. Using small tweaks only, of the rear mirror & etalon only, do step (21); then do step (23); patterns will be fuzzier & may be narrowed horizontally.

84) With the beam blocked, remove everything after the SHG oven from the IR beam line of the harmonics box, & then set up the power measurement system per step (53). Temporarily put a white card in the beam, between the laser chassis & the power meter (or, after the wedged flat if that is used). Detune the SHG to the second or third side lobe, & adjust the input energy to attain a comfortable brightness. Set up the monitor etalon ass'y (refer to 970301) to view the spot on the card. Increase the input energy to E_{39} & adjust the YAG etalon tilt for maximum output & then (after adjusting SHG brightness A/R-NOT to central lobe, however) for the "cleanest" monitor etalon display.

85) With the beam blocked, reinstall the first SHG beamsplitter (i.e. on the IR beam line), & install the beam dump on the SHG output beam line. Retune the SHG to the central lobe. Check the beam profile. A/R, optimize the profile by making small adjustments to the aperture & then to the rear mirror (only). If the beam quality is now substantially worse than it was before inserting the etalon, reduce the input & go back to step (83); it may be necessary to reduce the etalon tilt, being careful not to align the etalon perpendicular to the beam.

86) Repeat step (84), & then photograph the monitor etalon display & calculate the linewidth per 970301. Fill in the linewidth boxes of Test Report 970307 if specification is met. Measure & record the input & the IR output in the COMMENTS of 970307 (e.g. "output w. MY-E was 220 mJ @ 31 J").

87) Set the input energy to slightly above threshold & close the shutter. If this system has MY-SAM but not MY-SP skip to step (98); if it has neither, skip to step (110). Otherwise, remove the MY-E ass'y & reclose the beam line.

Install MY-SP

88) Remove the 0060-3961 Quarter-Wave-Plate Ass'y & its mounting hardware to a storage position, reclosing the beam line with the 0060-4883 beam tube. Install the 0060-5511 SP Waveplate Ass'y & 0060-5400 Shim in place of the two 0060-5390 Beam Tube Plates. Use the He-Ne to align the waveplate parallel to the rear mirror & then tilt the waveplate horizontally (either direction) until its reflection no longer is visible at the He-Ne laser. Turn the Q SWITCH rotary switch to LONG & open the shutter.

89) Do steps (20) thru (23); the mirrors should not require more than very minor tweaking.

90) Increase the input energy to E_S; CAREFULLY rotate the waveplate so as to maximize the output (lowering the input A/R): failure to adjust the waveplate in minimal increments may damage the laser! Reduce the input nearly to threshold & close the shutter.

91) Use the He-Ne to align the waveplate parallel to the rear mirror. Block the beam line (e.g. with a white card) anywhere between the osc. polarizer & the rear mirror.

92) Open the shutter. While monitoring between the polarizers for lasing, increase the oscillator input until lasing occurs. Adjust the waveplate pitch and yaw, and the oscillator input, to get the most symmetrical pattern (typically a central lobe and four corner lobes) at the lowest input. Reduce the input just enough that lasing never occurs: call this energy E_{PRE}; record it in the COMMENTS of 970307. Set the Q SWITCH rotary switch to EXT.

93) Unblock the beam line & survey between the polarizers for lasing. If lasing is observed, tweak the Pockels Cell settings to minimize (or stop) it, & reduce the input A/R so that lasing never occurs.

94) Turn the Q SWITCH rotary switch to INT. Detune any harmonics. Put a white card in the IR beam; set up the fast photodiode ass'y to view the IR spot on the card, & display the resultant waveform on the fast 'scope. Fine-adjust the waveplate's pitch & yaw (BUT NOT ROLL!) to minimize the modulation on the displayed waveform. Close the shutter.

95) While taking care to suck the soldering "smoke" away from the laser and exhaust it outside the lab, modify Pockels Cell Driver Ass'y 060017 as follows:

A. Rev. C & Earlier

Replace R26 (22Ω) by a 1 kΩ, ¼W, 5% resistor (Mp/n 4702-0315).

B. Rev. D & Later

Remove R26 (22Ω).

96) Open the shutter. Refine the adjustments of step (94). Measure & record the IR output & the osc. input in the COMMENTS of 970307 (e.g. "SP output 195 mJ @ 23 J input"). Set the input to slightly above threshold, & close the shutter.

97) If this system does not have MY-SAM, skip to step (110). Otherwise, undo step (88); use the He-Ne to ensure that the back-reflection from the 0060-3961 Quarter-Wave-Plate Ass'y is not visible at the He-Ne laser (cf. step (8) of 970292, He-Ne Alignment Procedure).

Install MY-SAM

98) Install the MY-SAM etalon ass'y, using the He-Ne laser to ensure that it is tilted approx. 3/4° horizontally only (to either side; the angle between the incident & reflected red beams will be approx. 1.5°, which will produce an offset of approx. 5/16" per foot or 26 mm/m).

99) Do step (95), unless already done (during MY-SP installation); then do step (83). With the beam blocked, remove everything after the SHG oven from the IR line of the harmonics box, & then set up the power measurement system per step (53). Detune the SHG to the second or third side lobe.

100) Increase the input energy to attain roughly 100 mJ of IR output (with the SHG ass'y in, the corresponding power meter indication is roughly 70 mJ). Put a white card in the beam and set up the monitor etalon ass'y (refer to 970301) to view the green spot on the card. Adjust the SAM etalon tilt to obtain the fewest and most widely spaced rings, as stably as you can (the display stability will get better or worse as you adjust the SAM etalon, but probably will not be very stable even at its best, at this point).

101) Close the shutter. Install the "unetalon" ass'y (0060-3986 Cavity Mirror Ass'y and 0060-5400 Shim, together with one of the two 0060-5390 Beam Tube Plates provided with the laser). Use the He-Ne to align the unetalon parallel to the rear mirror. Block the beam line (e.g. with a white card) anywhere between the osc. polarizer and the SAM etalon.

102) Open the shutter. While monitoring between the polarizers for lasing, increase the oscillator input until lasing occurs. Adjust the unetalon pitch and yaw, and the oscillator input, to get the most symmetrical pattern (typically a central lobe and four corner lobes) at the lowest input. Reduce the input just enough that lasing never occurs: call this energy E_{PRE}; record it in the COMMENTS of 970307. Set the Q SWITCH rotary switch to EXT.

103) If this laser has the 060467 Beam Tube Box Ass'y, replace it with the 060548 Beam Tube Box Ass'y (SAM). The SAM shutter should be closed, and nothing should be plugged into the SAM BNC receptacle. Unblock the beam line and survey between the polarizers for lasing.

A. If lasing is observed,

tweak the Pockels cell settings to minimize (or stop) lasing. (If lasing stops, do (103B); otherwise, proceed to (104).)

B. If lasing is not observed,

turn the Q-SWITCH VOLTAGE ADJUST pot CCW until lasing is observed on every shot.

104) With the aid of the IR card or viewer, slide the SAM Prelase Ass'y (060535) so that the beam reflected from the back of the osc. polarizer, more-or-less enters the prelase ass'y's aperture. Connect the SAM BNC, via 50Ω coax (RG-58 or equiv.) to the vertical input of a 'scope (use a 50Ω termination if the 'scope input is not 50Ω). Start with 2 μs/div., 1 V/div., internal trigger, + slope. Open the SAM shutter, slide the prelase ass'y to maximize the peak of the first spike, then lock down the prelase ass'y (3 screws). The peak of the first pike should now exceed 5 V; if it doesn't, turn the Q-SWITCH VOLTAGE ADJUST pot slightly further CCW, until either a 5+ V signal is obtained (in which case, proceed to step (105)) or no increase in amplitude is noted (in which case, debug the prelase ass'y).

105) Replace the 'scope cable at the SAM BNC by the SAM cable (to the mcc socket): the laser should now be lasing in the Q-switched mode. Reduce the osc. input to the lowest setting at which lasing occurs on every shot. Set up the fast photdiode ass'y to view the spot on the white card, and display the resultant waveform on the fast 'scope.

106) Fine-adjust the unetalon, then the SAM etalon, & then the Pockels cell angles to minimize any modulation on the displayed waveform (you may also be able to reduce the osc. input slightly, at this point). If you obtain smooth, unmodulated pulses, skip to step (108); otherwise, do step (107). (Note: if you see a second pulse, 10's of ns later, one of the cavity end mirrors may be misadjusted slightly.)

107) Reduce the osc. input until all lasing stops. Reduce the Q-switch voltage until lasing occurs on every pulse. Reduce the osc. input to the lowest setting at which lasing occurs on every shot. Go back to step (106). If progress is very slow in this sequence, &/or if the beam quality is not good & can't be fixed by minor adjustments of the Pockels cell angles &/or the unetalon, it may be necessary to reduce the etalon tilt (being careful not to align the etalon perpendicular to the beam), redo steps (83), (102), & (103) -- set VOLTAGE ADJUST fully CW first -- & start again at step (106).

108) Check the monitor etalon display for a stable pattern of resolution-limited rings (if you see anything else, call for help). Close the SAM shutter, remove the SHG oven, reopen the SAM shutter, & measure the IR output. Record the IR output & the osc. input in the COMMENTS of 970307 (e.g. "SAM output 95 mJ @ 20 J input").

109) Close the SAM shutter. Turn the Q-SWITCH rotary switch to INT. Set the input energy to slightly above threshold, & close the (laser) shutter. If it is desirable for some reason to undo SAM at this point, the unetalon ass'y need not be removed: instead, while watching the reflection of the He-Ne beam from the unetalon, you may merely tilt the unetalon horizontally (either direction) until the reflection no longer is visible at the He-Ne laser.

MY32 Output (Expanding) Telescope

NOTE: Step (110) applies only to MY32.

110) If this system has one, install the output telescope ("+" lens at the output end; both lens cells screwed all the way in). This telescope can be adjusted only in use with a YAG-pumped dye laser.

111) If a YAG-pumped dye laser is part of this order, align & test it (& the YAG output telescope) at this time, then do QA performance inspection.

112) With the shutter closed, install the hole plugs in the mirror mount plates. Open the shutter to confirm that the beam profile has not changed. CAREFULLY remove any Allen wrenches, that were left in adjustment screws, while watching the beam profile. Close the shutter.

113) Make sure that all of the beam tubes, & all of their rubber interconnecting hoses, have been installed. Check that all components & all locking adjustments (aperture slides, telescope jam nuts) are securely tightened. (If any are loose, check the beam profile & positioning at less than full power before & after--during, if practical--the tightening operation). Shut the system down completely & return all settings to those of step (2). On Test Record 970307 fill in the EVENTS COUNTER/FINAL READING & TEST HOURS boxes. Install the hole plugs in the chassis end plates.

114) Carefully & throughly vacuum the inside of the laser chassis, making sure not to touch any of the optics in or after the harmonics box (dust or lint there, may be blown off with the filtered duster). The vacuum cleaner exhaust should be directed away from any clean or semiclean areas. Using an alcohol-dampened lint-free wiper, remove any remaining contamination (again, avoiding the optics; if any of these are contaminated, clean per pp. 4-3, 4-4 of the Installation, Operation, & Maintenance Manual). Clean the harmonics box lid & install it (clean up any particles generated by wrenching down the bolts). Put Cap-plugs over the output window(s).

115) Perform the BRH Final Inspection (Test Report 970307); the locations of the BRH warning labels are shown in Fig. 8 of the Installation, Operation, & Maintenance Manual.

116) Each laser head should have a "DANGER HIGH VOLTAGE" label (1" x 1.5") on top; the perforated box ("Faraday cage") over the Pockels cell driver board should also have such a label.

117) A "DANGER VOLTAGE" label, made by cutting up one of the labels referred to in step (116), should be affixed to the top of the support panel for the master control card, so that it can be read with the card in place.

Secure for Shipment

118) Disconnect the flashlamps; Ty-wrap the connectors to any convenient points of the structure, so they won't be harmed in shipment. Make sure that the wiring & plumbing are secured (NOTE: away from the Invar rods!) against shock & vibration. Tighten the base-plate-mounting shoulder screws. Install the top covers. Install Cap-plugs at the output ports.

119) Check that the Power Console is secured against shock & vibration except for the reservoir. The final plumbing between the Power Console & the Laser Chassis should be polyethylene (not Tygon) tubing, attached to the umbilical with plastic spiral wrap; if it is not, make it so, & clear bubbles per step (5). Dump the reservoir & then put in about ½ gal. of absolute (200 proof) ethanol (ethyl alcohol). Clear bubbles per step (5). Dump the reservoir & finish securing the power console (including restoring the original remote control connector plug).

120) Disconnect the plumbing at the laser chassis; promptly replace it with a Tygon jumper: do not allow tne laser chassis to drain. Disconnect the city & DI water plumbing at the power console; allow the DI water hoses & the console to drain. Connect the free DI water hose ends together (at each end of the umbilical). Put a Tygon jumper at the DI water connections on the power console. Blow the city water out of the power console IN THE DIRECTION OF FLOW. Remove the plug from the AC power cord. File the signed-off Test Report after putting a copy at the front of the Installation, Operation, & Maintenance Manual (except photo originals go with IOMM, photo copies go to file) & providing a copy to Service.

121) Take the system to Shipping, along with the items (preferably bagged up together) specified in Spare Parts Kit 060366 (& Shipping Check List 970285).

Lab Cleanup

122) Damp-mop the test-area floor. Wipe down the bench(es) with alcohol-dampened lint-free wipers. Start on p. 4 with the next system.

MP MASTER
MA32971